THE ENGINEERING CONSTRUCTION WEEKLY

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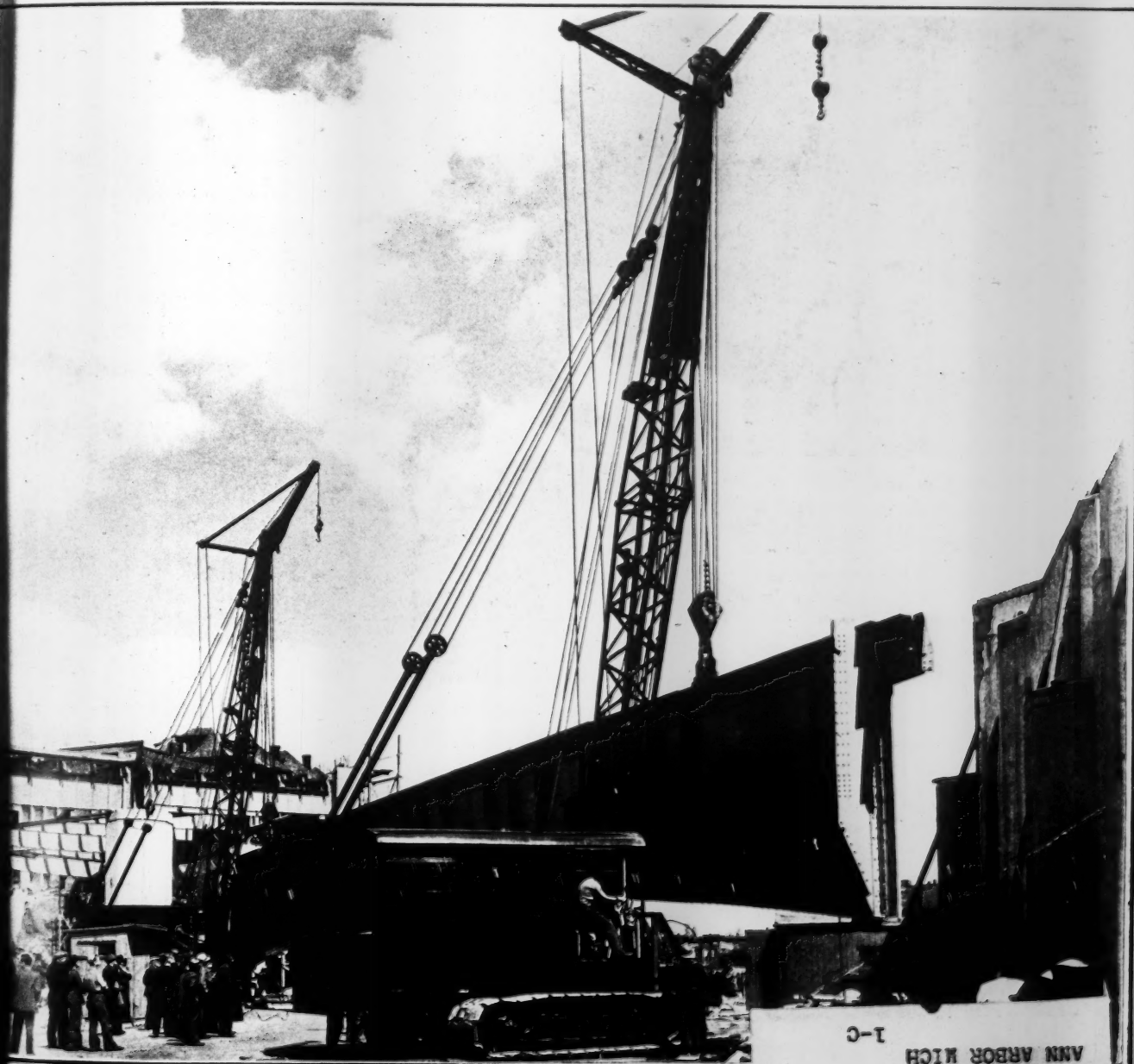
Engineering NEWS-RECORD

May 19, 1938

Erecting a 100-ton Girder in New Jersey approach to Lincoln Tunnel



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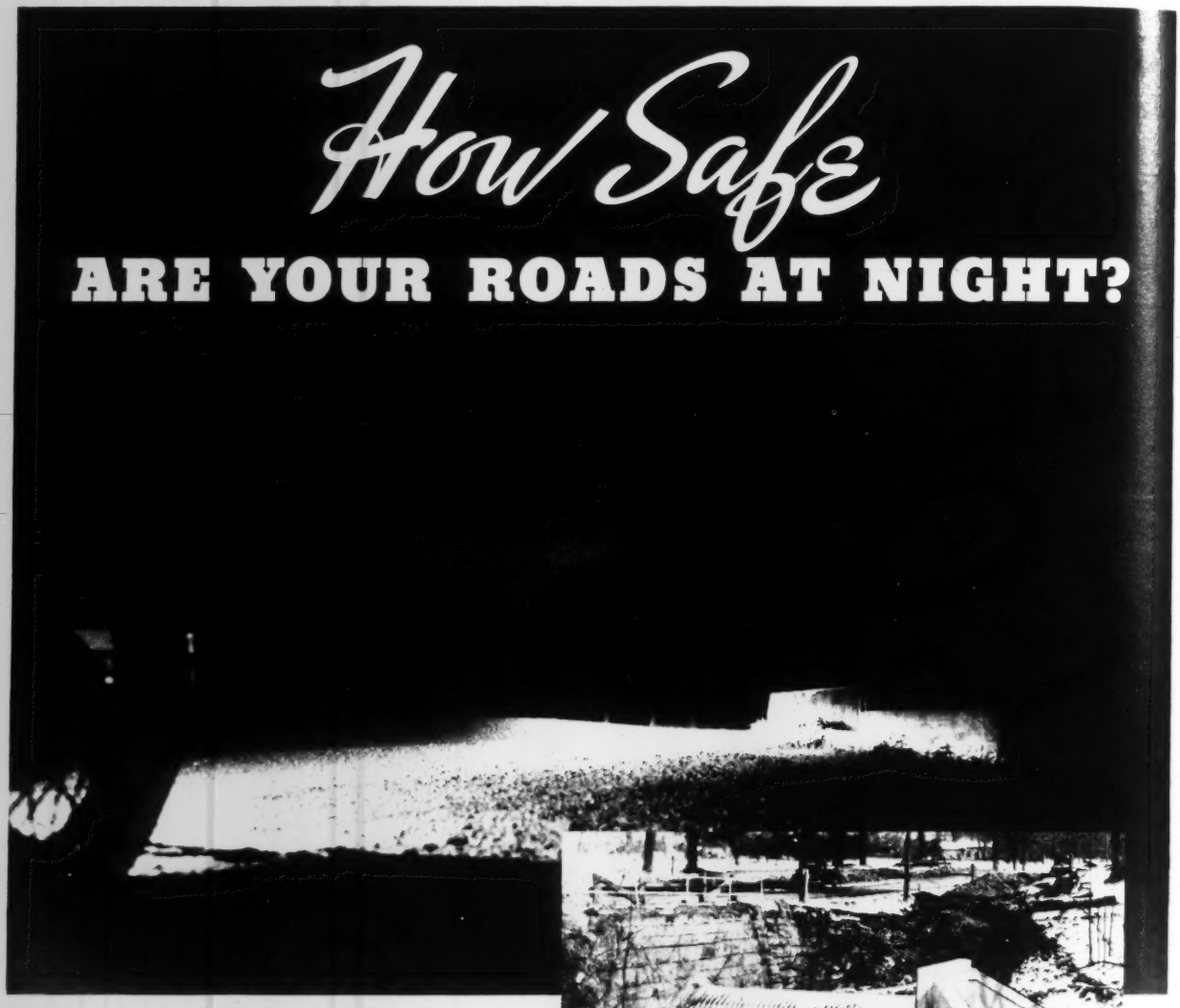
How Safe ARE YOUR ROADS AT NIGHT?



Above: A one-way bridge like this is doubly hazardous under cover of darkness. The solid abutment crowding the roadway is a menace to traffic.

Right: Widening a narrow bridge with Armco Multi Plate. It required only a few days to make the bridge span as wide as the highway.

REPLACE DANGEROUS NARROW BRIDGES WITH ARMCO MULTI PLATE

Every narrow bridge is a potential "death trap." Darkness simply multiplies the hazard. That is why many highway departments are modernizing unsafe bridges by widening or replacing them with Armco Multi Plate.

Besides eliminating a major cause of accidents, such a program will reduce maintenance costs and make highways more attractive. By using Armco Multi Plate, the work can be done quickly and economically with unskilled labor and the simplest equipment. Moreover, in many cases it will not be necessary to interrupt traffic during installation of the corrugated iron plates.

Start now on a safety drive. Inspect your roads at night. Tab the most dangerous spots. Then widen or replace these narrow bridges with Armco Multi Plate. Ask an Armco representative to give you full details. Armco Culvert Manufacturers Association, 703 Curtis St., Middletown, Ohio.

MULTI ARMCO PLATE

ARMCO MULTI PLATE

A PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

THE WEEK'S EVENTS

Pump Priming Bill Passes House

Hundred million additional is earmarked for rural electrification from RFC funds

Provision of an additional $100,000,000 for self-liquidating loans by the Rural Electrification Administration was the only major change made by the House of Representatives in passing, by a vote of 329 to 70, the resolution giving effect to President Roosevelt's pump-priming message. Although many amendments were proposed, including one to forbid PWA financing of projects competing with private business, all but a few were voted down. The exceptions were minor, the most important serving to shift the closing deadline for PWA non-federal applications forward from August 31 to September 30, 1938—giving 4½ months to apply.

In the account in last week's issue (*ENR*, May 12, 1938, p. 665) of the introduction of the public works appropriation bill, it was incorrectly stated that "no applications will be received by PWA after Aug. 31, 1939."

Already granted $40,000,000 for the coming fiscal year in the independent offices appropriation bill, REA now has on hand applications for approximately $90,000,000, with more coming in daily. Friends of the agency prevailed upon the appropriations committee to sponsor an amendment to the pump-priming bill authorizing an additional $60,000,000 to be loaned REA by the Reconstruction Finance Corporation. This amendment was in turn amended, on the motion of Rep. Rankin of Mississippi, to increase the authorization to $100,000,000. The Rankin amendment was adopted by a vote of 124 to 118 and the committee amendment (as increased by the Rankin amendment) by 259 to 139.

MAJOR NEWS

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Second Lincoln Tube Not to Be Finished

The north tube of the Lincoln tunnel under the Hudson River between midtown Manhattan and New Jersey will not be completed at this time, the Port of New York Authority announced May 17. The tunnel, now under construction, was recently holed through.

The concrete lining, floor, and ceiling of the north tube will be installed within a few months under contracts already let, and the tunnel can be placed in use when required in the future without much delay.

Failure of the state of New Jersey to construct new highways to connect with the tunnel approaches and thereby generate sufficient traffic to require the use of two tubes, along with present unsatisfactory economic conditions, are stated to be important reasons for the decision. Also influencing the decision was the ease with which present traffic is being handled in the existing south tube.

The decision to defer opening the second tube is expected to effect "a considerable saving in interest cost and in operating expenses without in any way interfering with the orderly flow of traffic."

Work on the westerly approach system between Weehawken Plaza and New Jersey State Highways 1 and 3 will be continued to an early completion. This approach system is designed to handle two tubes of traffic.

The state of New Jersey has been advised by the Authority that the tunnel cannot produce sufficient revenue fully to service the debt of $85,000,000 until adequate highways are provided.

Federal Highway Aid Reduced by Senate

Report on super-highways is asked in Senate version of Hayden-Cartwright bill

The Senate on May 16 passed the Hayden-Cartwright federal highway aid bill with amendments sharply reducing the authorization contained in the bill passed by the House last week. Whereas the House bill provides $125,000,000 for federal aid to the states in each of the two years, 1940 and 1941, the Senate bill provides $75,000,000 the first year and $115,000,000 the second. The total authorizations in the bill are reduced from the House figure of $238,000,000 in each year to $128,500,000 the first year and $186,000,000 the second.

The Committee on Post Offices and Post Roads justified the reduction in federal aid on the ground that carry-over funds amounting to $150,000,000 would be available.

The Senate included a provision asking a report by the Bureau of Public Roads on the development of a federal system of super highways.

The amounts in millions of dollars provided by the Senate and the House in the bill are shown in the table below.

	1940	1941
Federal aid	75	115
Secondary roads	10	10
Grade crossings	20	30
Forest roads	10	13
Public land roads	1	2
National parks	4	5
National parkways	6	8
Indian roads	2.5	3
	128.5	186

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E.C.P.D. Will Review Education Survey

A "Report on Engineering Education in 1937" is to be prepared and published by the Engineers Council for Professional Development. The work will be financed by a grant of $10,000 from the Carnegie Foundation for the Advancement of Teaching. The publication will be based on information gathered by the E.C.P.D. committee on engineering schools during the investigations it made for the purpose of accrediting engineering curricula.

Local Flood Money Is Reduced

House committee reports flood control bill—low-lying communities to be evacuated

Important modifications and clarifications in federal flood control policy, as well as additional project authorizations with a total cost to the government of $375,000,000 are contained in an omnibus flood control bill favorably reported to the House May 13 by its flood control committee.

The committee, in its report, recognizes the fact that there are many more worthy projects than can now be authorized. It has, therefore, approved in principle comprehensive plans for each of the drainage basins included in the bill, but has actually authorized only those more important projects recommended by the Chief of Engineers. Later, as more money becomes available, it is hoped to proceed further with actual authorization and construction.

Local cooperation

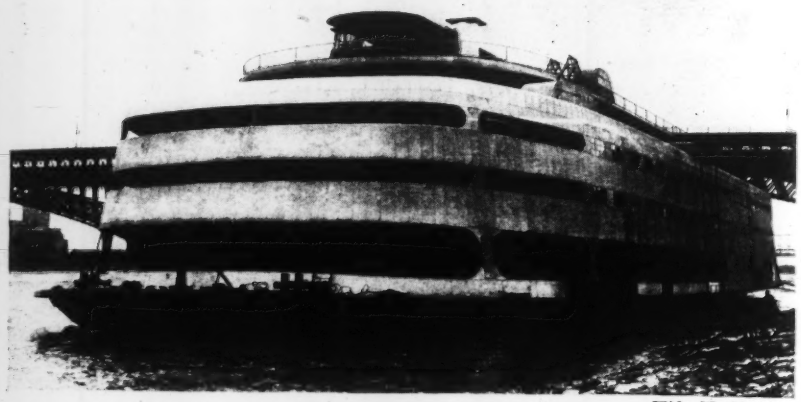
Recognizing values in the requirement that local interests provide lands and flowage rights, the committee yet faces the necessity for modification of this requirement in respect to flood-control reservoirs. In the two years that have intervened since flood control was accepted by the federal government as a national responsibility only a comparatively small number of reservoirs has been constructed, and it is apparent that this type of control will lag unless some modification of the requirement is effected.

The bill therefore provides that local interests shall still handle acquisition of lands, easements, and rights-of-way, but that they shall be reimbursed by 70 per cent of their actual expenditures for such purposes. This applies only to reservoirs, not to flood walls and other form of local protection.

Power development

The bill continues the former instruction that all reservoirs in connection with which power development is practicable contain penstocks for generating equipment.

Two of the projects authorized—the Denison Reservoir on the Red River, Texas, and the Bluestone Reservoir on the New River, W. Va.—are multi-purpose developments on which power will be developed immediately. As regards the Denison project, it is directed that the United States buy directly all lands, easements and right-of-way, and that the local cooperation take the form of a monetary contribution amounting to 30 per cent of the cost of lands chargeable to flood control, less the capitalized value of the excess value of the project as estimated by the Chief of Engineers. The Bluestone authorization is a repetition of the provision carried in the flood control act of 1936.



Wide World Photo

OLD MAN RIVER GOES STREAMLINED

BUILT to ply the Mississippi as a pleasure steamer, this streamlined craft is shown undergoing finishing stages of construction at St. Louis.

Regional planning

The bill opens with the flat declaration that investigation, planning and prosecution of rivers and harbors for flood control and allied purposes shall be a responsibility of the Corps of Engineers. While no mention is made directly of the reports of the National Resources Committee or of pending legislation providing for regional planning boards, the attitude of the committee toward water-resources planning is made clear in its report: "The professional planners advocate the covering of too many proposed activities in one report with the result that we do not receive sufficient definite information to legislate for the specific improvements that are practically and urgently demanded. Many of the so-called related activities are connected with the important activities too remotely. . . . The committee believes that the Congress and the country have had enough of theoretical planning. It is time for action."

Water retardation

The report comments favorably, however, on the results of cooperation between the Corps of Engineers and the Department of Agriculture since 1936, when the latter was charged with responsibility for soil conservation, reforestation, and other methods of water retardation within the drainage basins. Continuance of this work is assured by the authorization of $2,000,000 annually for the five years ending June 30, 1944. In addition, an annual $375,000 is authorized to extend and improve the flood forecasting service of the Weather Bureau.

Evacuation of communities

Another new departure is the provision that, in cases where the cost of protection of an area from flood damage can be reduced by the evacuation of part or all of it, the Chief of Engineers is authorized to use the money thus saved in construction costs to pay the cost of such evacuation and the rehabilitation of the inhabitants. The committee points out that, particularly in the Ohio Valley, the abandonment of certain areas will not only save in the cost of protection, but will also widen the flood plain and thus reduce flood heights.

Lower Mississippi floodways

The bill revises legal provisions that have held up construction of floodways on the lower Mississippi River by simplifying the acquisition of land and flowage rights and by divorcing the Eudora and Morganza floodways, so that they can be built independently.

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Small Earth Dam Fails In Minnesota

A small earth dam at Mount Lake State Park, 4 mi. northeast of Luverne, Minn. failed May 5 under the action of flood waters following a heavy rainstorm. A 20-ft. section at one end of the dam and a 70-ft. section at the other were washed out.

The dam was built last year as a WPA project at a cost in the neighborhood of $30,000.

THE CURRENT TREND

This week's news of contract volume and construction cost factors

Concrete-Bar Cement Ratio

Increased ratio of concrete reinforcing bar to cement production raises questions on records and trends

A reader of *Engineering News-Record* has asked for an explanation of why the ratio of production of reinforcing bars to cement has varied so widely since 1929. In the past three years, 1935, 1936 and 1937, it has been successively 7.3, 9.1 and 7.3. The accompanying chart shows this variation graphically, with both material production curves compared with *ENR* Volume Index 3-year moving average.

Portland cement production in U. S. for 1937, 116,500,000 barrels, and production of concrete reinforcing bars, 845,000 gross tons for the same period, show 7.3 gross tons of reinforcing bars produced per 1000 barrels of cement. This production ratio is a decline of 20 per cent from the peak of 9.1 gross tons per 1000 bbl. cement reported in 1936; equal to the 1935 ratio; 16 per cent above the 1934 ratio; and 26 per cent higher than any ratio recorded from 1909 through 1933.

From 1909 through 1918, cement production averaged 82,410,000 bbl. per year and reinforcing bars averaged 317,100 gross tons, or a ratio of 3.8 tons of bars to each 1000 bbl. cement. This was a climb from 2.4 in 1909 to 4.9 in 1918. In the following ten year period, 1919 through 1928, cement averaged 135,700,000 bbl. per year, while bars averaged 653,500 tons, an increase in the average ratio from 3.8 to 4.8, but, excepting for the low ratio recorded in 1921, bar production per 1000 bbl. of cement remained fairly constant. In the years 1929 through 1937 the average ratio increased to 5.7 gross tons of bars to 1000 bbl. cement, a 19 per cent gain over the period from 1919 to 1928, and 50 per cent over the 1909 to 1918 average.

The shipment ratio of bar tonnage to cement is 6.9 in 1937, 17 per cent below the peak ratio reported in 1936, but from 4 to 21 per cent higher than any other yearly ratio since 1933 when bar shipments were first recorded. The shipment curves show the same general trend as production, except from 1934 through 1937 where an accumulation of bar stocks is indicated.

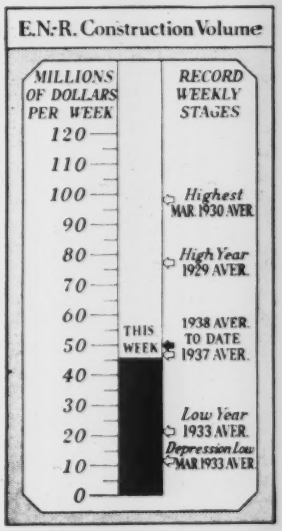
Explanations of these changes in the concrete bar-cement production ratio have been offered, suggesting that reinforcing or concrete bar statistics have been more complete since 1929 than previously, when it is possible that reinforcing bar statistics may not have included plain bars which were classed as merchant bars, but ultimately sold as reinforcing.

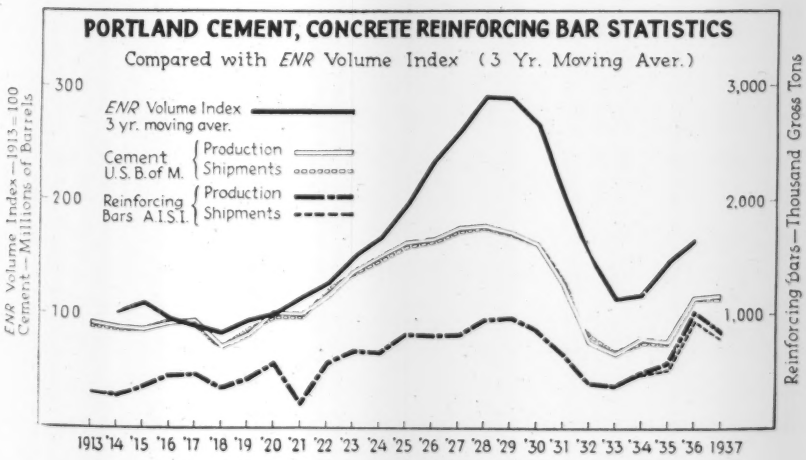
It has also been suggested that bridge construction uses a high ratio of reinforcing bars to cement. Bridge construction was high in 1936, the highest year on record, when the grade crossing elimination program under the $400,000,000 federal grant reached its apex.

Possibly readers familiar with trends in concrete design will be able to supply further explanations of contributing causes to this rise in the ratio of concrete bar production to cement production.

• • •

EMPLOYMENT in the production of six major construction materials stands at 47.9 for March, 1938, an increase of 0.7 points, or 1.5 per cent over the 47.2 reported for February by the PWA National Resources Committee, based on 1923-25=100. The current index is, however, 22 per cent below the 61.2 reported last March.




PORTLAND CEMENT, CONCRETE REINFORCING BAR STATISTICS
Compared with ENR Volume Index (3 Yr. Moving Aver.)
ENR Volume Index—1913=100
Cement—Millions of Barrels
Reinforcing Bars—Thousand Gross Tons
300
200
100
3,000
2,000
1,000
ENR Volume Index 3 yr. moving aver.
Cement U.S.B.of M. Production Shipments
Reinforcing Bars A.I.S.I. Production Shipments
1913 '14 '15 '16 '17 '18 '19 '20 '21 '22 '23 '24 '25 '26 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 1937

THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending May 20 1937	May 12 1938	May 19 1938
Federal	$2,361	$3,700	$1,421
State & Municipal	14,266	49,800	26,850
Total public	$16,627	$53,500	$28,241
Total private	38,617	15,520*	17,373
TOTALS	$55,244	$69,020*	$45,614

Cumulative
1938 (20 weeks) $999,015*
1937 (20 weeks) $913,413

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

* Revised.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 20 Wk.	1938 20 Wk.
NON-FEDERAL	$540,258	$472,518
State & Mun. bonds	219,145	233,976
Corporate securities	242,539	119,600
PWA loans, grants	48,635	2,029
RFC loans	29,939	63,420
U.S.H.A. loans	.....	53,493
FEDERAL	.....	$86,532
TOTAL CAPITAL	$540,258	$559,050

F H A MORTGAGES

	Cumulative 1937 19 Wk.	1938 19 Wk.
Mortg. selected for appraisal	$249,876	$305,877

ENR INDEX NUMBERS

Index Base	1913	1926
Construction Cost (May)	236.80	113.83
Building Cost (May)	197.86	106.97
Construction Volume (Apr.)	176.00	77.00

Power Districts Plan To Buy Utilities

Ask PWA permission for $90,000,000 program to combine all power sales in Nebraska

Three large power districts in Nebraska—the Platte Valley, the Central Nebraska, and the Loop—have asked PWA to approve the principles involved in a plan under which the districts would buy out private utilities in Nebraska to set up a unified system of power generation and distribution. Permission from PWA is required because the financing plans proposed would alter somewhat the arrangements for securing payment of money loaned the districts by PWA.

The districts propose immediately to purchase ten of the smaller companies by means of a bond issue of about $20,865,000. The three remaining companies operating in Nebraska would be purchased later by means of an issue of about $70,000,000. Each district would purchase the companies operating in its territory.

The districts have been carrying on negotiations for some time with the utility companies and with certain private banking interests. "These negotiations," the districts state, "have reached a point where the districts have reasonable assurance that the proposed purchases can be consummated. . .

"The prices to be paid for these properties have been or will be arrived at by a survey of properties made under the supervision of J. D. Ross. . . We believe that the offers we will make are fair and reasonable, and if the districts are unable to consummate these purchases in a reasonable time, they will proceed with the construction of competing facilities and endeavor to obtain the market for their power as rapidly as possible."

The purchases will be financed by the sale of 4 per cent debentures to private banking interests. The first issue, of about $20,865,000, will cover the cost of acquisition of the first ten companies and will also provide operating funds for the district and funds for construction of connecting facilities. The acquisition of the other three companies is to be carried out "as rapidly as possible."

Financial arrangements

If PWA agrees to the proposed plan, the business of the three districts will be considered as divided into generation and distribution departments. The generation department will sell power to the distribution department at rates such as to meet the expenses of distribution and to service the PWA loans. The private loans will be serviced from the income of the distribution department.

The proposed rate schedule to be paid by the distribution department will be as follows:

Power produced by the facilities bought from the private companies will be sold at its actual production cost. Firm power, produced by the hydroelectric plants and used to replace power now produced by private plants, will be sold at the cost of production in the acquired plants, but the rate will not be greater than 7 mills per kw.hr. Other firm power produced by hydro plants will be sold at not more than 7 mills per kw.hr., and dump power produced by these plants will be sold at not more than 3 mills.

Advantages sought

In their letter to PWA, the districts assert that their plan will provide an immediate market for the output of their hydro plants and will provide an adequate operating fund for each district to start operation. In addition, the plan will eliminate the cost of duplicating existing facilities in order to obtain a market for hydroelectric power, will eliminate "wasteful and bitter competition" with the private companies, and will permit immediate integration of existing properties to reduce overhead expenses and permit rate reductions. When the loans are paid off, the plan will result in power being sold to the consumer at cost.

THEODORE B. PARKER

CARL A. BOCK

APPOINTMENT of Theodore B. Parker and Carl A. Bock as chief engineer and chief consulting engineer, respectively, of the TVA was announced in these pages last week. (*ENR*, May 12, 1938, p. 668). Parker was formerly chief construction engineer and Bock was assistant chief engineer.

The position of chief engineer has been vacant since 1935, when A. E. Morgan gave up the title; the position of chief consulting engineer is new.

TVA and City Offer to Buy Tennessee Utility

The Tennessee Valley Authority and the city of Knoxville on May 12 submitted a joint offer of $7,500,000 for the electric properties, exclusive of certain transmission lines, of the Tennessee Public Service Co. The offer contemplated that the city would buy properties inside Knox County and the TVA would purchase those outside the county.

The present offer is about $1,500,000 more than was offered for the properties in 1934. At that time a sale agreement was reached, but consumation of the sale was prevented by litigation over TVA constitutionality. Now that injunctions blocking municipal power in the TVA area have been dissolved, the sale can go ahead.

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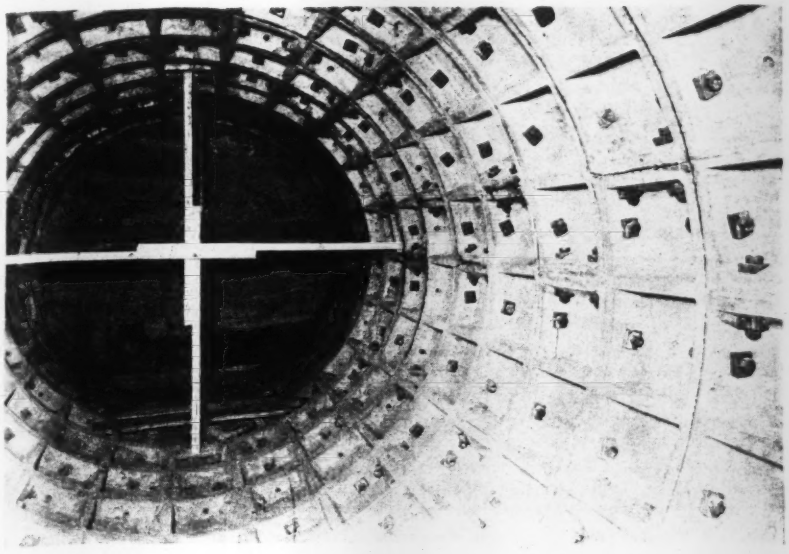
High School Building Fails In Construction

The third floor of a three-story brick and steel high school building under construction at Ellsworth, Pa., collapsed on May 11, bringing the walls down with it immediately afterward and almost completely destroying the building. Twelve workmen on the structure were injured.

The school house was being built by the Brownsville Construction Co. It was financed by means of a PWA loan of $140,000.



CONCRETE LINING FOR LONDON SUBWAYS

PRECAST sections of reinforced concrete are being used to line the new subways now under construction in London. This plan was adopted because of the scarcity of metals in England due to the present armament program (*ENR*, April 14, 1938, p. 525).

Shown above is the lining of an experimental tunnel in west London constructed to test the new lining.

Milwaukee Water Blamed For Gastro-Enteritis

Outbreaks of gastro-enteritis in the Milwaukee area last February were blamed by the Wisconsin board of health on pollution of the city's water in a report completed May 5.

"No negligence," the report held, "can be attributed to the health or waterworks authorities . . . since chlorine residual appeared ample at all times and the B. Coli index of the tap water was well below accepted . . . standards." It appeared, according to the report, "that the water treatment facilities available in the city at that time were inadequate for purification of water for an emergency of the character experienced during the outbreak."

Disagreement with the state's conclusions was expressed by Milwaukee health commissioner J. P. Koehler. "There is room," he said, "for honest differences of opinion. I do not believe the water supply can be blamed. My findings . . . show that the epidemic probably was spread as colds are spread—by personal contact, air contamination and contamination of pools and ditches, etc."

The city council is discussing the possibility of asking the U.S. Public Health Service to decide between the two opposed viewpoints.

The state board of health based its conclusion on the fact that pollution of the raw water supply was observed at the time of the outbreak, Feb. 7-21, that the disease affected about 27,000 people nearly simultaneously, that the incidence of the disease was largely confined to areas using the Milwaukee water supply, and that those persons contracting the disease outside that area had recently visited Milwaukee.

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Sewage Plant Opened For Twin Cities

The $16,000,000 sewage disposal plant of the Minneapolis-St. Paul sanitary district was dedicated May 16. The plant, on Pigs Eye Island south of St. Paul, will be in complete operation June 1; the intervening period will be used in gradually opening the plant. Minneapolis sewage will be brought in first and then St. Paul sewage.

The plant provides screen and grit chambers, flocculating and settling tanks, and effluent filters. Sludge disposal is by concentration tanks, vacuum filters, and incinerators. Under low river flow conditions, about 10 per cent of the time, chemical treatment will be used. The project also involves 50,000 ft. of interceptor sewers.

The plant will treat an average flow of 134 m.g.d. and a maximum flow of 610 m.g.d. It was designed to serve a population of 910,000 in 1945.

Construction of the plant was started in July, 1934. It was financed by a PWA grant of 30 per cent of the cost of labor and materials and a privately subscribed bond issue.

Power Rates Set At Bonneville

FPC asked to approve separate flat rates for at-site and transmitted power from the dam

Schedules of rates for the sale of electric power from the Bonneville project on the Columbia River were submitted on May 11 to the Federal Power Commission for its approval by J. D. Ross, administrator of the project. Under the Bonneville power act, FPC approval is required for rates set by the administrator.

The proposed schedules set up flat rates for power in the immediate vicinity of the dam and another set of flat rates for power from the general transmission system for resale.

The Federal Power Commission has announced incomplete figures on the proposed schedule. From these it appears that the proposed rate for firm power at the site, sold for resale, is $14.50 per kw.-year; for secondary power, $9.50 per kw-year; and for surplus power, 2.4 cents per kw. day. Surplus power is defined as any available power in addition to that under contract. Power at the dam site for the purchaser's own use would also be available, under another schedule.

The proposed schedule for transmitted power for resale calls for a rate of $17.50 per kw.-year for firm power, $11.50 per kw.-hr. year for secondary power, and 2.88 cents per kw-day for surplus power.

Power for resale will be available to states, public power districts, counties, municipalities, public bodies, cooperatives and privately owned electric utilities. Secondary and surplus power will only be sold to purchasers already having contracts with the United States for firm, interchange, or standby power.

In calculating the rates the following factors were considered:

1. As announced by the Federal Power Commission on Feb. 8, 1938, the construction cost of the plant allocated to the initial power installation is $11,682,400. Interest on this at 3½ per cent, and amortization in 40 years, gives an annual charge of $547,055.

2. Annual maintenance and operating expenses chargeable to the initial power installation are estimated at $170,680.

3. The estimated cost of the transmission system is $14,608,450, with an annual cost of $1,242,216.

4. The capacity of the plant by the time the transmission system and two additional generators are completed will be 194,400 kw.

J. B. Strauss Dies At Los Angeles

Chief engineer of Golden Gate bridge and specialist in design of bascule bridges

Joseph B. Strauss, chief engineer of the Golden Gate Bridge and for 30 years a well-known specialist on bascule bridges died in Los Angeles on May 16 following a heart attack. Strauss was 68 years old and, although he had recently been in ill health, his condition did not become serious until about a month ago.

Born in Cincinnati, Ohio, Strauss graduated from the University of Cincinnati in 1892, and after two years with the New Jersey Bridge & Iron Co. at Trenton returned to the university where he was an instructor in civil engineering for the next three years. Then, after two years with the Sanitary District of Chicago, he became principal assistant to Ralph Modjeski, leaving in 1902 to enter consulting practice in the bridge field and, in 1905, to form the Strauss Bascule Bridge Co., later the Strauss Engineering Co. and finally Strauss & Paine, Inc., which he headed until his death.

Best known for his activities in the field of movable bridges, Strauss held some 20 patents on the trunnion bascule bridge and several on lift bridges, principally a "direct-lift" type which substituted pins and links for the usual cables and sheaves. One such bridge was built in Louisville in 1915 and another in Ottawa, Canada in 1918. His bascule bridges, the first of which was built for the W. & L.E. R.R. at Cleveland in 1905, are more numerous than any other bascule design. They are in three principal types—the vertical overhead or hanging counterweight, the underneath or deck counterweight, and the heel trunnion type. All are characterized by an operating mechanism involving a system of balanced levers in the form of a parallelogram, of which the counterweight comprises one side. The latest and largest Strauss bascule, spanning the mouth of the Chicago River in the new Outer Drive viaduct, was opened last year.

The early success with the bascule bridge turned Strauss away from the field of bridge design, in which he had shown uncommon ability, to the business of selling bridges, although he maintained an unswerving interest in inventions of all kinds. The experience gained in the bridge promotion field stood him in good stead when he turned his active talents to the problem of bridging the Golden Gate. Where others had failed, he succeeded. And although his original design, presented in 1919, of long cantilever arms supporting a 2,700-ft suspension span was not adopted and although credit for the design and building of the bridge belongs to members of his firm, to Prof. C. A. Ellis, then of his firm, and to the members of the consulting board, the Golden Gate Bridge, nevertheless, is Strauss' achievement. It is generally agreed that without his promotional effort and his tenacity of purpose there would have been no bridge.

Nearly 500 movable bridges are said to have been built by Strauss in his lifetime. Among other notable bridges, not of the movable type, designed and built by him and his firm are the Columbia River cantilever at Longview, Wash. and the St. Lawrence River cantilever at Montreal, the latter designed in conjunction with Monsarrat & Pratley, Canadian consultants.

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Price Fixing Is Charged In Hardwood Lumber

A tendency to monopolize the sale and increase the price of hardwood lumber and building materials is charged by the Federal Trade Commission to arise from the activities of the Hardwood Institute. A complaint has been entered by the commission charging conspiracy to fix uniform prices against the institute and 24 manufacturer members operating mills in northern Michigan and Wisconsin.

It is charged that the companies have made agreements and understandings among themselves and with others to fix prices and to divert trade in lumber and building materials from dealers and manufacturers who do not join or cooperate with the institute. Prices, it is charged, are fixed and enforced by filing of prices with the institute and threats of boycott.

Michigan companies named in the complaint are the Antrim Iron Co., The Bay de Noquet Co., the Brownlee Co., Northwestern Cooperage and Lumber Co., the Von Platen & Fox Co., Weidman Lumber Co., I. Stephenson Co., and The Wisconsin Land & Lumber Co.

Wisconsin manufacturers named are William Boniface Lumber Co., Holt Lumber Co., Kinsel Lumber Co., Marathon Paper Mills Co., Menominee & Bay Shore Lumber Co., the Oconto Co., The Rib Lake Lumber Co., and The Underwood Veneer Co., the M. J. Wallrich Land & Lumber Co., Roddis Lumber & Veneer Co., Sawyer-Goodman Co., Thunder Lake Lumber Co., the Yawkey-Bissel Co., and the Yawkey-Alexander Lumber Co.

Two other companies named, The Bonniface Gorman Co. and The Edward Hines Lumber Co., have their principal places of business in Chicago.

Change Cement Buying For Reclamation Jobs

Cement purchasing for the Bureau of Reclamation is now being handled through the Procurement Division of the Treasury Department, in accordance with the new federal policy for centralizing purchases of this material. In the case of normal types of cement the bureau's requirements are being lumped with those of other federal agencies in a series of contracts, each covering all federal requirements for one or two states.

The procedure is somewhat different in the case of special cements, of which considerable quantities are used in reclamation work, but which are not widely used for other purposes. When the need for a special type arises specifications are prepared and bid invitations issued by the Denver office of the bureau, but the resulting bids are submitted to the Procurement Division in Washington. No final award is made without consultation with the bureau's technical staff.

In accordance with this procedure an award was recently made for 35,000 bbl of sulphate-resisting cement for use in Wyoming. The successful bidder was the Monolith Portland Midwest Co., at $2.20 per barrel packed in cloth sacks, f.o.b. Laramie, Wyo., less 50c. per barrel for the return of the sacks. Other bidders were the U. S. Portland Cement Co., and the Colorado Portland Cement Co., each of which bid $2.25 f.o.b. Boettcher, Colo.

Bids were opened May 16 for 6,000 bbl. of finely-ground standard portland cement to be used in Montana. The Oregon Portland Cement Co. bid $2.50 f.o.b Lime, Ore., less 10c. per bbl. for payment by the 10th of the month following delivery, and the Three Forks Portland Cement Co. named a price of $2.50 per bbl. f.o.b. Trident, Mont., less 10c. for payment in 15 days.

• • •

Shasta Bypass Tunnel Contract Awarded

Contract for construction of the Shoo-fly tunnel at Shasta Dam in the Sacramento River canyon north of Redding, Calif., was awarded May 11 to the Colonial Construction Co. at Spokane on its low bid of $426,000.

The Shoo-fly Tunnel will be driven 1,600 ft. through the west abutment at the dam site. During the early stage of dam construction it will be used to carry the main line of the Southern Pacific R.R., which runs through the canyon. Later, the tunnel will be used to divert the river. At that time, the railroad will be routed over its permanent relocation above the water level of the proposed reservoir.

U. S. Engineers Photo

FORT PECK BARGE TURNS AMPHIBIAN

PUMP BARGE No. 3701 has completed a 1¾ mile journey, powered by 14 tractors, from the core pool at the top of Fort Peck Dam to the Missouri River downstream. The barge was floated into the closure section of the dam along with three other pump barges about a year ago. When the Missouri was diverted and dredges began to place material in the old river channel, the pump barge was used to remove waste water from the core pool. As the fill, and the core pool with it, rose, it became necessary to use the barge as a booster in the dredging line.

The barge was taken from the core pool on April 30, pulled up skidways to the west abutment and placed on skids. Nine 75-hp., four 90-hp., and one 50-hp. tractors were used to pull the 150-ton hulk down a coulee and over the flats to the river. Even though water was trained on the skids while it was moving, the heat generated was so great that it was necessary to stop at frequent intervals and wait for the skids to cool off.

Cement Contracts Let In California

Seven bids were received May 12 and a contract was awarded the following day by the Procurement Division of the Treasury Department for furnishing 250,000 bbl. of moderate-heat portland cement on an f.o.b.-mill basis to various federal jobs in California. Contract was awarded to the low bidder, the Monolith Portland Cement Co., at a price of $1.63 per bbl., less 10c. per bbl. discount for payment in 30 days, f.o.b. mill at Monolith, Kern County, California.

Other bids ranged from $1.64 per bbl. to $2.10 less 10c for payment in ten days.

This is the first award to be made by the government under its revised plan by which all federal cement purchases are centralized in the Procurement Division and bidding is limited to producers on the basis of quotations f.o.b. point of production or point of storage. Additional bids have been called for, to be opened May 17 and 18, on five other contracts covering different sections of the country, and additional calls will be issued soon.

High Court to Pass On TVA Legality

The U. S. Supreme Court on May 16 accepted an appeal from a three-judge district court decision, upholding the constitutionality of actions of the Tennessee Valley Authority, in the case brought by eighteen utility companies affected by TVA competition.

The court also granted the petition of the federal Attorney-General for permission to intervene in the pending suit brought by Nebraska against Wyoming and Colorado over the division of waters of the Platte River. The Attorney-General's petition has attracted attention because one of the arguments advanced as the basis for intervention is the claim that all unappropriated waters in the western states belong to the federal government, rather than to the individual states, on the basis of the old treaties.

The court on the same day agreed to review a challenge brought by the Consolidated Edison Co. of New York to the right of the National Labor Relations Board to take jurisdiction over a utility company operating within a single state.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

THE SUPREME COURT on May 16 upheld the action of a three-judge district court in dismissing a case brought by the California Water Service Co. seeking to prevent the city of Redding, Calif., from receiving a PWA grant for the construction of a municipal water system. The Supreme Court agreed with the district court that the questions at issue had been decided in the Alabama Power Co. case.

THE COURT, on the same day, ruled that the state of Indiana might properly collect a gross income tax on proceeds from state and municipal bonds, even though such bonds had been declared by state law to be tax exempt. The court held that there was doubt whether the state's action in declaring the bonds tax exempt constituted a contract and that in any case the taxes referred to were property taxes on the value of the bonds rather than income taxes.

THE FEDERAL POWER COMMISSION on May 13 adopted an order authorizing a federal license for the Possum Kingdom Dam of the Brazos River Conservation and Reclamation District, Texas. On the following day the commission received a formal request from the Brazos district for a rehearing on the commission's finding of April 13 holding that the development affects navigation and is therefore subject to a federal license.

ALTHOUGH the proposal to build a network of super-highways over the country has been shelved by Congress, considerable support is being rallied among Eastern Congressmen for a bill by Rep. Drew of Pennsylvania for the construction of such a road between New York City and Washington. Proponents argue that this section, along which traffic density is extremely heavy, would serve as a demonstration of the value of such facilities which, if successful in this case, could then be extended to other sections of the country.

THE BAILEY BILL liberalizing appeals to the courts from decisions of the Federal Power Commission was reconsidered May 16 and sent back to committee. Thus the senate vote of May 5 (*ENR*, May 12, 1938, 670) was cancelled. The bill would permit any aggrieved person or public agency to appeal.

LABOR NOTES

A CONFERENCE between representatives of the Am. Soc. C. E. and the F.A.E.C.T., C.I.O., in order to draw up a model form of collective agreement for engineering employees was proposed by the executive committee of the C.I.O. union of technicians at a meeting May 8. The committee proposed that the Am. Soc. C. E. adopt and its employer members endorse a form of agreement incorporating minimum rates of pay, seniority rights, severance pay, and limitation of apprentices. It was further suggested that the society endorse protection of the patent rights of employees, extension of the merit system in all communities, and government projects for the relief of unemployed engineers.

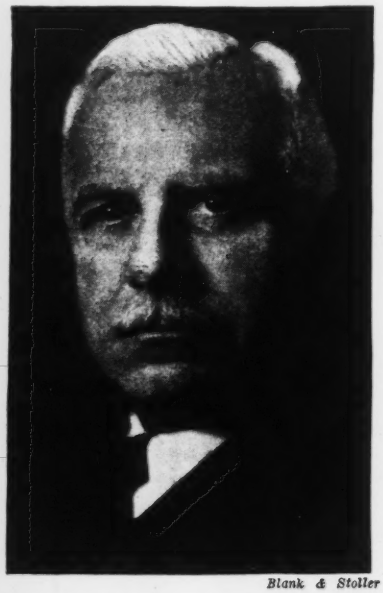
AT THE SAME meeting, the executive committee, commenting on the recent report on unionization prepared by a committee of the Am. Soc. C. E., endorsed the position taken in the report that membership in a union was a matter for the individual engineer to decide and welcomed efforts by the society to improve the economic conditions of engineering employees. The federation proposed that employer members of the society should be required to comply with labor laws as a condition of membership.

A TEN DAY strike of excavation chauffeurs in St. Louis ended May 10 when contractors yielded to the demands of the Teamsters Joint Council No. 13 for a wage scale of $1 an hour.

ELECTRICIANS in Spokane went on strike May 9 demanding a wage scale of $1.37½ and a six-hour day to replace the present $1.25 and seven-hour day. A wage agreement expired last October, and since that time negotiations for a new contract have not been successful.

A VOLUNTARY pay cut of 22½ cents an hour has been accepted by the United Brotherhood of Carpenters at Tamas, Wash. in order "to stimulate home building and remodeling during the summer." The new scale of 90 cents an hour applies only to private construction and is effective until Aug. 1. Heavy industrial construction will continue at the $1.12½ scale now prevailing in the Portland area.

A RESOLUTION urging a federal investigation of unemployment among technical men was adopted by the executive council of the Federation of Architects, Engineers, Chemists and Technicians at a special conference called to consider plans for organization in the auto industry and the federal navy yards.



Blank & Stoller

Transit Engineer Dies

Eugene Klapp, for many years active in the construction of municipal rapid transit facilities and since 1906 a member of the New York consulting firm of Parsons, Klapp, Brinckerhoff & Douglas, died May 11 at Sandwich, Mass. at the age of 70.

Graduating from the Columbia School of Mines in 1899, Klapp served for six months with the Chicago architects, Holabird & Roche, and then went to work with the Chicago and South Side Elevated R. R. He rose in eight years from the position of draftsman to that of chief engineer. He then served for a year in the Spanish American War, emerging with the rank of Captain, and was for a brief time manager at New Orleans for the National Contracting Co. of New York City.

In 1900, Klapp became division engineer of the New York Rapid Transit Commission, working on the development of the first subway system in the city. He was later chief engineer of the Brooklyn Rapid Transit Co. In 1906 he joined with Wm. Barclay Parsons, former chief engineer of the Transit Commission, to form the consulting firm of Barclay Parsons & Klapp.

Since 1906, in the course of his consulting practice, Klapp has held responsible positions on many projects, including the Cape Cod canal, docks in Havana Harbor, the Almandares bridge there, the International Telephone and Telegraph Building in Madrid, and the Detroit vehicle tunnel.

Act Against Halts On Housing Projects

Building Trades Department of A.F.L. resolves to fix wages and prevent jurisdictional disputes

Action to prevent stoppages of work arising from jurisdictional disputes on public housing projects and to hold wage rates on these projects at the levels in effect when work starts was taken May 9 by the executive council of the building and construction trades department of the A.F.L. The council, after conference with Walter Price, acting director of the labor relations division of U.S.H.A., wrote to its affiliated local building trades councils approving in principle two resolutions to carry out these aims. The council urged that the local bodies adopt similar resolutions.

Jurisdictional disputes

The first resolution provided that in case jurisdictional disputes arise on any low-rent housing project of the U.S.H.A., no stoppage of work take place until the department, the local housing authority, and the U.S.H.A. have had an opportunity to adjust the differences.

The second provided that wage rates in effect at the time work is commenced on any contract unit of low-rent housing project remain in effect until completion of the project. This applies to single contract units only.

Resolutions providing for stability of wage rates on low-rent housing projects have already been adopted by building trades councils in New York City, Charleston, Youngstown, and Buffalo. In each case the resolution has been submitted to and approved by all local building trades unions in the council involved.

• • •

Alton Dam Lock Builder Sues Government

Damages of $407,000 are being sought from the federal government by John Griffiths & Sons Co. of Chicago in a suit brought in the U. S. Court of Claims May 9.

The Griffiths company was the contractor on locks, for Alton Dam on the Mississippi River. While building the locks, in 1935, the company claims that its was required to carry on the work "in the face of abnormal, excessive and extremely hazardous river conditions" contrary to sound engineering practice. Delays in completing the project, the firm charges, were caused by flood water and other conditions beyond its control.

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Paging Sewer Experts

Sir: We have had recent opposition to the use of semi-elliptical reinforced concrete storm sewer design. Our design provides for the pouring of the bottom slab as a first step and the secondary monolithic pouring of the side walls and top. Our figures indicate that this type of invert develops a considerable saving in materials and affords the proper strength. The forming and pouring are relatively simple matters and when completed will be considerably under the cost of concrete pipe or box culvert of the same cross section area.

Are there any reasons, not readily apparent, to preclude the use of this type of invert? This design has been used in the past and I know no reason why it should be abandoned. Any comments will be greatly appreciated.

A. F. RIDEOUT,
City Engineer De Ridder, La.

Nicaragua Canal

Sir: The letters on the Nicaragua Canal in your issues of April 14 and 21 both contain several errors of fact and various untenable assumptions, most of which are not supported by the reports which have been made on the project.

The plan of gradually turning the Panama Canal into a sea level channel would be considerably more of a job than that assumed by Mr. Smith, but Mr. Randolph is in error in his statement that the tidal range on the Pacific side furnishes a complete answer to arguments in favor of this possibility. The 20-ft. range is the maximum and bears a much less proportion to the total length of the sea-level strait than the 9-ft. maximum range of tide in Cape Cod Bay, which has not prevented the army engineers in charge from rejecting a plan for a tidal lock and widening the channel from its original 100-ft. to a present 500-ft. width. It could hardly be claimed in any case that the destruction of one tidal lock, which is required only at times of extreme high and low water, was comparable with the risk of a flight of locks holding the lake level at 85 ft. above sea level.

Mr. Randolph also states that no solution has ever been offered to control the flood waters of the Chagres, and is apparently unaware of the existence of the Madden Dam at Alajuela.

As regards the question of defense, it is necessary to bear in mind that the Navy is the first line of defense of the Canal and a naval defense of two canals does not require double the strength necessary for one, whereas the Navy's security is doubled by having an alternative route for crossing the Isthmus. It would be difficult to sustain Mr. Smith's thesis that an air force capable of successfully attacking one canal could as easily wreck two. His final statement as to the time to be saved by the passage of Panama as compared with one at Nicaragua has no meaning, as he does not say between what points he proposes to save the time. The last report of the Inter-Oceanic Canal Commission set the passage of the Nicaragua Canal at 24 hr., as compared with seven or eight hours at Panama, and whether there is a saving of time by either route is entirely dependent upon the ports between which the trip is made.

It would seem as if enough study had been given to the Isthmian Canal question in the past century to obviate the necessity of making guesses on the subject.

HENRY WELLES DURHAM
New York, N. Y., Apr. 25, 1938

Gilbertsville Project

Sir: In your issue of April 28, 1938, appears a discussion by Theodore T. Knappen of my article on the Gilbertsville project. Mr. Knappen raises questions which are among those that naturally arise in the minds of engineers. In the case of the Gilbertsville project, because of its cost and importance, more than usual precautions have been taken in the investigations and planning. Technical studies of all phases of the project have been made by a staff of capable engineers. These studies have been thoroughly reviewed by both groups of consultants mentioned in my article. These consultants are engineers and geologists of broad experience both in water control and utilization projects and in dam construction. They have given their approval as to the feasibility of the project and as to its effectiveness for accomplishing its objectives. Mr. Knappen, of course, writes without the benefit of the detailed studies made by the Authority.

CARL A. BOCK
Chief Consulting Engineer
Tennessee Valley Authority
May 13, 1938

Parabola Solution

The following corrected letter was published in the issue of April 14. Due to typographical errors the definition of e and formula (1) were in error, so that the solution was useless. —EDITOR

Sir: On reading C. E. Sharp's article on p. 799 of the Nov. 11, 1937 number of *ENR*, I decided to send in a little information on parabolas that is often helpful.

D = difference in elevation of end of base line.

L = span or horizontal length of parabola.

d = added height from point on curve at center of span to maximum point.

M = middle ordinate of curve.

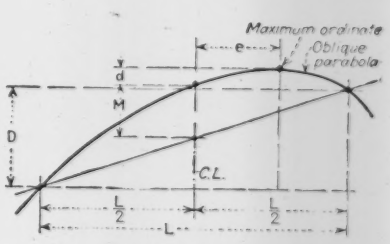
e = distance from C. L. to maximum point.

$$e = \frac{1}{8} \cdot \frac{(D)}{M} L \qquad (1)$$

$$d = \frac{1}{16} \cdot \frac{(D)}{M} D \qquad (2)$$

Formulas (1) and (2) may be used to find maximum ordinates on highway curves and on moment curves for continuous structures and to find the positions of maximums for ease and accuracy of plotting.

C. W. DEANS
Estimator, Western Bridge Co., Ltd., Vancouver, B. C.



Drawing showing parabola symbols

ENGINEERING NEWS-RECORD

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Editorial Offices at 330 West 42nd Street, New York

MAY 19, 1938

LAST WEEK the House of Representatives passed the new relief bill without major changes from the form in which it was first drawn up by Administration forces. The bill revives the PWA and gives it nearly one billion dollars with which to finance work that can be completed before June 30, 1940. But, though the bill thus appears to favor work that can be done through normal construction channels its whole effect is to expand rather than contract relief agencies. The earmarking of funds is very general; wide discretion is left to the Administration in the final allocation of funds. And past experience has demonstrated that every possible dollar will go to the WPA. This is inevitable under the present WPA system of doing any kind of work for any city that will put up enough money for materials and equipment to keep the WPA expenditures for labor up to a specified per cent of its total outlay. When WPA money is as easy to obtain as this few cities will borrow from the PWA or from private sources. Thus the relief system tends to perpetuate itself; schools, hospitals, parks, playgrounds and streets that should be built by private contract are built by relief agencies with relief labor, and the very people who should be working for the private contractor are thrown on relief.

Of More Than Local Concern

ARE GASTRO-ENTERITIS EPIDEMICS caused by waterborne infection? Since no one knows the answer and because of conflicting evidence there is justifiable reason for differences of opinion. Thus it happens that a proposal has been made in Milwaukee to call in the U. S. Public Health Service as a referee to settle a dispute between state and local health authorities regarding the cause of an epidemic last February which affected some 27,000 persons. State officials hold to the theory that the most probable cause was the water supply, noting, among other things, a correlation between the bacteriological changes in the water and the onset of the disease. City officials have reasons to feel otherwise and urge the appointment of a "referee". Those who have listened to discussions by water purification experts and medical men on the obscure character of gastro-intestinal epidemi- will appreciate the situation in Milwaukee. U- questionably both parties have justifiable reaso- to sustain their beliefs, but the fact remains th- findings in either case are not absolutely concl- sive. And since the need for definite informati- on such outbreaks is an admitted fact, every effo- should be made to enlist the skilled services o- the U. S. Public Health Service on a broad in- vestigation of this baffling problem. In this, Mi- waukee can and should take the initiative. Mor- than civic pride is involved—public confidence i- water supplies of every community of the enti- nation is at stake.

Integrating Activities

ENGINEERS in this country have given occasional thought to the possibilities of integrating the activities of technical and professional societies in the interest of economy of effort and money but only to conclude that the obstacles to such consolidation are almost if not quite insurmountable. But while we have talked of consolidation on this side of the border Canadian engineers have acted. Reported in this issue is the first definite step toward consolidation of the activities of the Engineering Institute of Canada with those of the provincial professional associations. Canada's problem is simpler than ours; they have one major technical society and relatively few provincial associations of engineers. But the basic problem is there, the problem of integrating societies whose membership is based on meeting a minimum legal requirement with a society in which membership is by election and is designed to be selective. The new set-up, if it is finally accepted, will eliminate the selective limitations insofar as registered engineers are concerned. Under these circumstances American engineers will watch the Canadian experiment with unusual interest.

Belts to Move Earth

BELT CONVEYORS for moving large quantities of earth have long been a well-recognized tool of contractors on construction. Early use began at least as far back as the Chicago Drainage Canal work but the first large application was at Wanaque Dam in New Jersey, a rolled earth fill containing nearly a million yards of material. In 1929 over four million yards of earth were moved out of Denny Hill in the center of Seattle using belt conveyors. More recently more than ten million yards were carried out of the cofferdam at Grand Coulee Dam by the same means. Belt conveyors now are being used at Quabbin Dam of the Boston water supply system. On that job the application of belts is chiefly notable for the variety of uses and refinements in detail. Thus, while the method

itself is not new, the contractors have again demonstrated their skill in adapting it to meet peculiar local conditions in the borrowpit areas.

Road Planning Discarded

HAPHAZARD roadbuilding is given preference over planned construction by the Senate through its reduction of the amount of money authorized in the House bill covering road work in the fiscal years 1940 and 1941. The House provided $238,000,000 for roadbuilding and grade crossing elimination in each of those years; the Senate committee cut this to $128,500,000 for 1940 and $186,000,000 for 1941, despite the strong protest of such staunch supporters of advance planning of road expenditures as Senator Hayden. What is the explanation of this forced economy when the Administration is committed to increasing public expenditures as an aid to business recovery?

Many explanations of this apparent inconsistency are put forward, chiefly based on political considerations that need not be discussed here. The serious part of the situation is its evidence of yielding to pressure from those in the Administration who are chiefly concerned with financing of relief operations. These people are not interested in the long-range planning that is the outstanding characteristic of our federal-aid highway system. What they want is money that has no strings to it, money which can be used when and where they please. This may be desirable from their point of view—and they probably are quite sincere in thinking that it is the best way—but it would be foolish to overlook the grave possibilities for abuse that are inherent in such provisions.

Relief bills of previous years have provided large sums for roads, streets and highways. There was no requirement that this money be matched by state funds or that its expenditure be supervised by the Bureau of Public Roads. The lack of restrictions made it attractive to local politicans, and explains the increasing demands for road money for relief purposes that has resulted in $425,000,000 road and street work being included in the new relief bill that has just passed the House. This expansion of WPA road work accounts for the failure of some states to take up their federal-aid money, a failure that is used by the Senate post roads committee as justification for its cut in federal aid for 1940 and 1941.

Shifting road funds to the WPA should be strongly resisted by all who favor planned and orderly development of our roads. It should also be resisted by those who sincerely seek to take people off the relief rolls and put them back on their own feet. Every dollar cut from the federal-aid appropriation means less work for which state highway departments will let contracts and for which contractors will be hiring men and buying materials and equipment. It will mean also that those who are not hired by these same contractors must look to the WPA for relief. The plan is truly the start of a vicious circle. The construction industry should make itself heard in opposition. The country needs to maintain its system of planned and carefully supervised highway building.

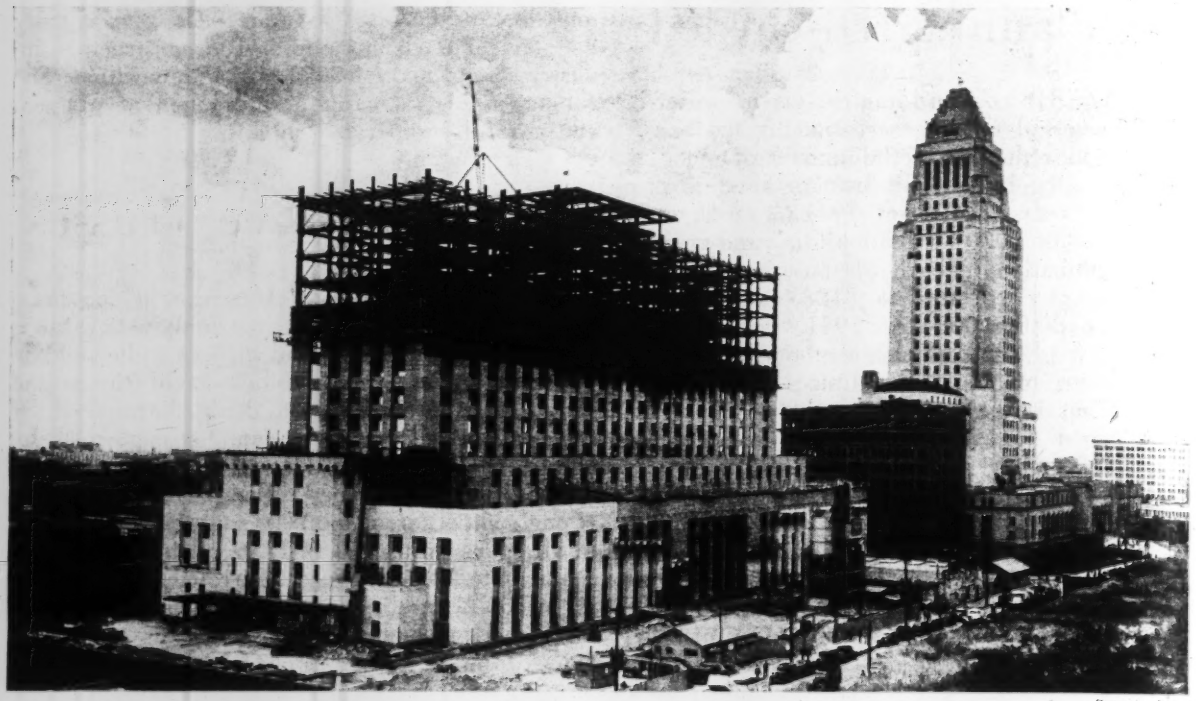
Girders Replace Trusses

A DEVELOPMENT in American bridge practice which becomes increasingly noticeable is the tendency for beams and girders to be used in place of trusses. The production of the rolled girder-beam in depths up to 36 in. introduced the trend about a decade ago and, strengthened by the growing liking of American engineers for continuous structures, the rolled-girder became a strong competitor of the truss and the plate girder in all spans up to 100 ft. Plate girders, in simple spans up to 200 ft. or more, narrowing still further up to 150 ft. or slightly more, with trusses holding their own for longer spans. Now, this balance is being upset by the adoption of plate girders for span layouts, continued to be accepted for spans the field of the truss.

In this issue, a plate girder span of 217 ft. in a continuous bridge at Topeka, Kans., is described as the longest in this country. Last year 200-ft. span plate girders were erected on the new Capital Bridge at Frankfort, Ky. and in the Figueroa St. viaduct at Los Angeles, both continuous bridges, while in the Henry Hudson Parkway at New York a plate girder 190 ft. long was erected as a simple span. All of these girders fall short of European practice where 200-ft. spans are not uncommon; one of 355-ft. span is used in Germany's Mangfall viaduct. Yet our progress continues, and before the year is out the New Jersey highway department will be building a 250-ft. span girder in its Raritan River bridge at Perth Amboy, which incidentally will have a maximum depth of 22½ ft. compared with 18 ft. on the Mangfall viaduct.

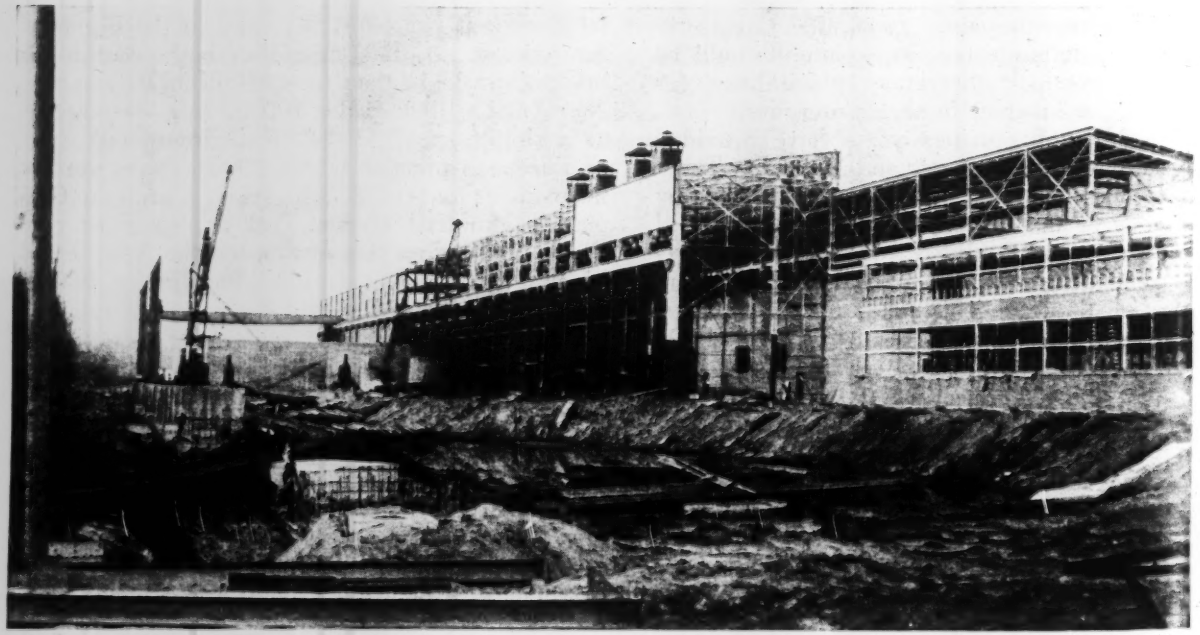
Remarkable as the increase in size of plate girders offer theoretical advantage over trusses in to more developments in view of the popularity of deck structures, the availability of large capacity fabrication and erection equipment and the increasing familiarity of American engineers with continuous structure design. And, since plate girders has been we probably can look forward fabrication and erection costs and in reduced maintenance expense, fewer rather than more truss bridges are the prospect of the future.

PICTURES IN THE NEWS



Sawyer Photo

HEAVY EARTHQUAKE-RESISTANT CONSTRUCTION *characterizes the new 17-story granite-faced federal building and post office in Los Angeles, in which 10,000 tons of structural steel frame with substantial knee-braces is enclosed in 58,000 cu.yd. of concrete and 5,000 tons of reinforcing bars. At the right is the city hall.*



De Long Photo

MORE MOTORS FOR TRUCKS. *Indianapolis is the home of this new $4,000,000 International Harvester plant for manufacturing truck motors, shown under construction. Principal buildings are the main factory and the foundry, each of which is of steel frame construction, with brick and glass sidewalls.*

Novel Earth Handling at Quabbin Dam

FREDERICK W. GOW
Senior Civil Engineer, Metropolitan District Water Supply Commission, Boston, Mass.

Hydraulic fill placed by gravity flow from high-level hog box fed by series of belt conveyors from three borrowpits

A CLEVER COMBINATION of earth handling equipment and methods has been developed by the contractor to place 3½ million cu.yd. of hydraulic fill at the Quabbin Dam for Boston's new water supply. Belt conveyors from three borrowpits converge at a hog box high above the east abutment of the dam, where dry materials are mixed with water pumped from the core pool for gravity flow to the discharge lines along the upstream and downstream beaches. An innovation is the use of rubber-lined steel pipe sections for the discharge lines. Three methods of excavation and haulage charge the conveyors: Shovels and trucks, shovels loading directly onto movable belt loaders, and carrying scraper excavation and hauling.

Quabbin Dam is the last major item to be built in the Quabbin Reservoir project which will provide an additional water storage of 415 billion gallons, collected from watersheds of the Swift and Ware rivers. The new reservoir lies in the Swift River valley about 65 miles west of Boston, and ties in with the existing water supply through a 24-mile tunnel aqueduct leading to the Wachusett reservoir (*ENR*, Sept. 11, 1930, p. 420, and Sept. 14, 1933, p. 310). Quabbin reservoir is formed by Quabbin Dam on the Swift River and the recently completed Quabbin Dike on Beaver Brook (*ENR*, June 18, 1936, p. 882). Both are hydraulic fill embankments requiring pneumatic caisson corewalls sunk to rock across the valley floor.

Quabbin Dam, 2,640 ft. long and 170 ft. high above streambed, will contain 4,000,000 cu.yd. of fill, ranking it as the second largest earth dam in the East, surpassed only by Saluda Dam in South Carolina. Completed under previous contracts were the river diversion tunnel (*ENR*, July 28, 1932, p. 102), which will later form the outlet control works, the pneumatic caisson corewall, upstream and downstream earth cofferdam and the main dam foundation grading. A typical cross-section of the fill is shown in Fig. 2.

Contract for the hydraulic fill, rolled fill topping, riprap, intake and control works and the saddle spillway, was let in July, 1936, by the Metropolitan District Water Supply Commission to the Benjamin Foster Co. of Philadelphia, lowest of nine bidders. Bids ranged from $2,317,445 to $4,555,800, though the first seven were within a range of $400,000. First hydraulic material was placed on May 19, 1937, and

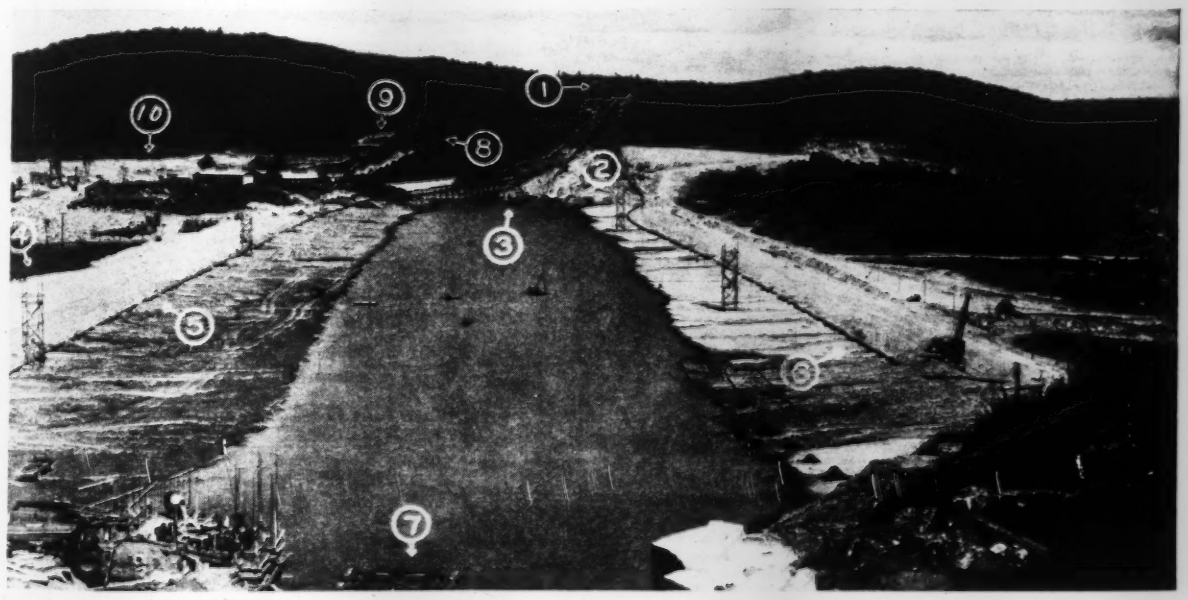


Fig. 1. **Hydraulic operations are simple and efficient: (1) Hog box and control station; (2) 28-in. clear water line; (3) Pump barge; (4) Light tower; (5) Upstream discharge line; (6) Downstream discharge line; (7) Stilling box for make-up pump discharge; (8) Main conveyor; (9) High pit; (10) Low pit.**

on Nov. 11, when operations were suspended for the winter season, almost 2,000,000 cu.yd. of fill had been placed.

The commission included with the specifications, plans and studies of five possible methods of construction operations, showing the permissible borrow areas and the manner in which the materials might be moved and placed. These plans included various combinations of low-level and high-level hog boxes, gravity flow and pumped discharge into the fill. They were suggestive only, for the contractor was at liberty to use any one of them or to create a new plan of his own. The Foster Co. elected to use a combination of two of the suggested plans, placing the hog box on a hill at the easterly end of the dam, transporting dry excavated material from three borrow areas to the box by belt conveyors, and delivery of the hydraulic mix to the dam by gravity.

Excavating and conveying

During the 1937 season the contractor operated borrowpits at two levels: one high pit at El. 600, and two low pits at El. 415. The low workings are in one large pit, though excavation is carried on in two places by different methods. All material is delivered to the hog box by a belt conveyor system consisting of six units. Last season the system totaled 2,695 ft. long; changes and additions have been made for this season's work.

The low borrowpit is in a modified drift formation spotted with sand and gravel pockets and crossed with lenses of rock flour. About 75 per cent of the material placed to date has been taken from this pit. The high pit is an unmodified drift or till formation.

Working against a 40-ft. face in the lower borrowpit are two 2-yd. diesel shovels. These load directly into hoppers on rails sliding over and feeding onto a 36-in. movable field conveyor 700 ft. long, traveling at a speed of 348 ft. per min. The supporting frame of this unit is in sections 40 ft. long, connected by flexible couplings. Each section is mounted on timber skids and the unit is moved by shoving the sections one at a time with a bulldozer. The two hoppers, moving on rails fastened to the conveyor frame, are equipped with 24-in. belt feeders 6 ft. long. This conveyor unit is carried parallel with the face of the cut within dumping range of the shovels at all times. About 50,000 cu.yd. of material can be handled without moving the unit, and when it is necessary to shift the conveyor the operation is completed in an hour or so.

Extending into another part of the lower pit is a second 36-in. conveyor unit, 500 ft. long, operated at 380 ft. per min. This unit, called the scraper conveyor, is charged by four 10-yd., one 7-yd. and one 5-yd. carrying scrapers, loading through a dry box mounted over the outer end of the belt. The scrapers, hauled by heavy diesel tractors, cover a wide area of the pit and permit a flexible excavation and hauling system.

The two pit conveyors converge toward and discharge onto a 36-in. stationary field unit 600 ft. long, traveling at a rate of 348 ft. per min. This unit, in turn, discharges onto a 54-in. feeder belt, 23 ft. long. The feeder is rather centrally located to all borrowpit locations. It is equipped with a variable speed motor permitting belt speeds from 50 to 74 ft. per min., with corresponding capacities of 650 to 1,250 cu.yd. per hour.

At the high pit are two more 2-yd. diesel shovels, working on a face 15 or 20 ft. high, limited by an underlying ledge. These shovels load into four 5-yd. dump trucks which haul to a dry set over the feeder conveyor unit. The box has a capacity of 32 cu.yd. and is arranged to ac-

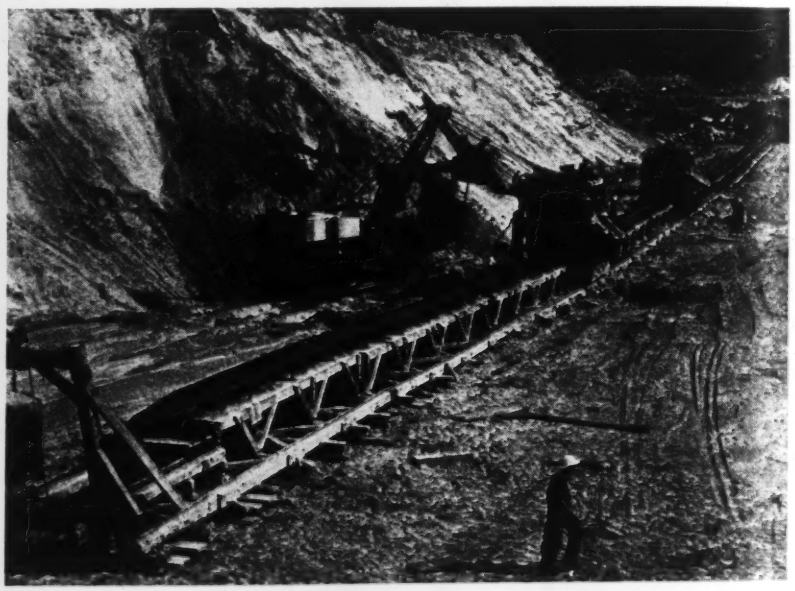


Fig. 3. Long belt-conveyor fingers reach out into the bottom pits to collect material for Quabbin hydraulic fill dam. At this unit shovels load into rail-mounted hoppers.

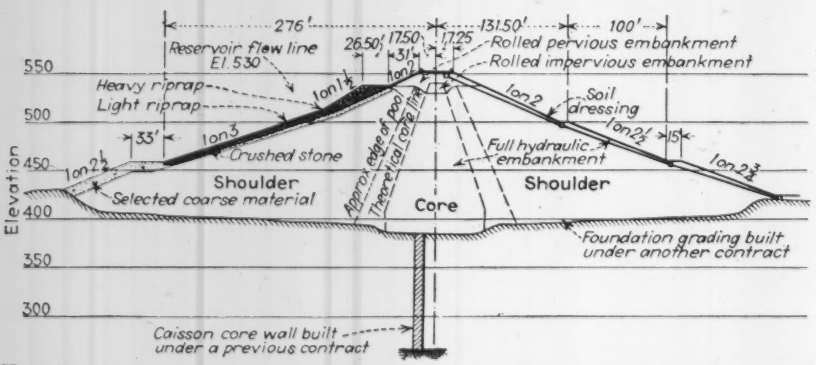


Fig. 2. Typical section of Quabbin Dam. The 4,000,000-yd. fill will rank as the second largest in the East.

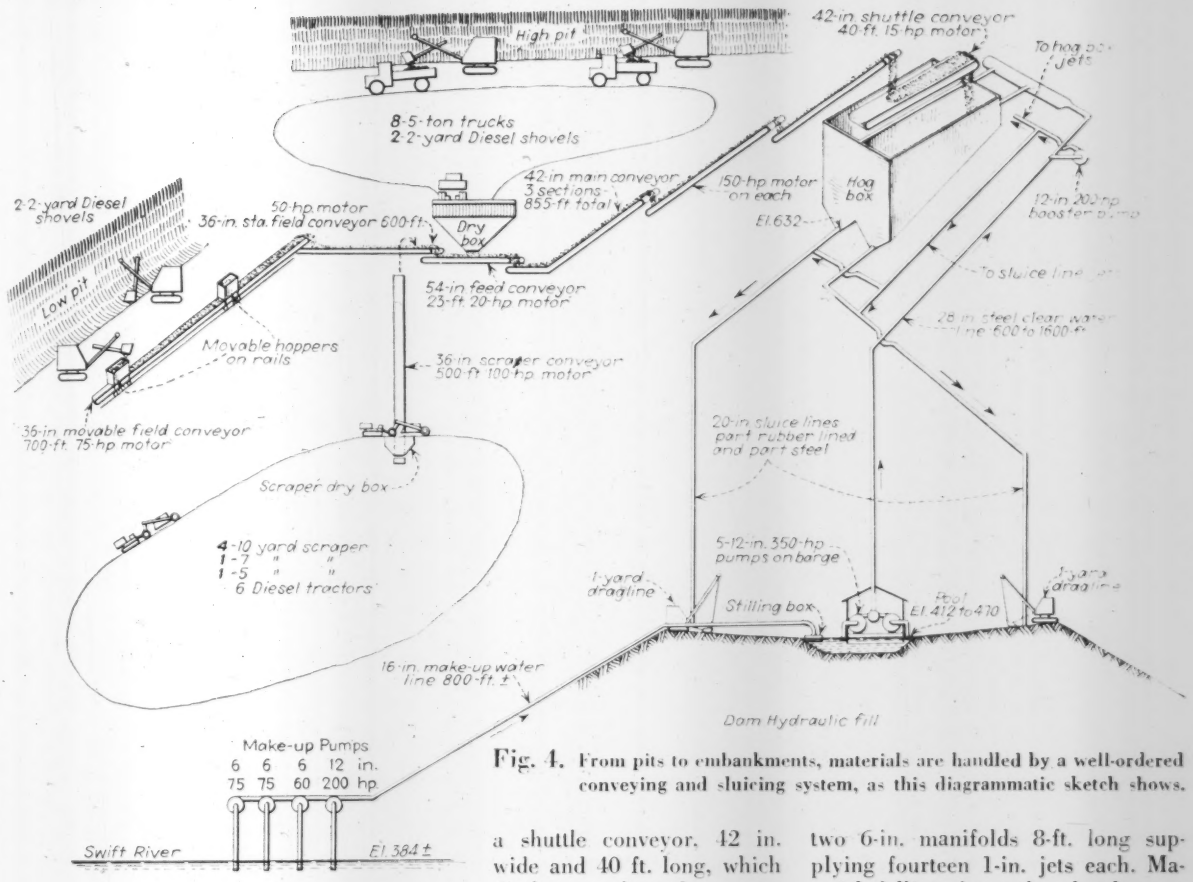


Fig. 4. From pits to embankments, materials are handled by a well-ordered conveying and sluicing system, as this diagrammatic sketch shows.

commodate two trucks dumping at the same time. An inclined bar grizzly in the box discharge chute rejects all stones over 9 in. in size. A half-mile haul from shovel to the feeder unit permits a trucking schedule of about four round trips per hour.

In early stages of the work before the field conveyors in the lower pit had been installed, the pit was worked by the scrapers and 8-yd. tractor wagons dumping into the same dry box used by the high-pit trucks. The wagons, tractor drawn, were loaded by the two diesel shovels later assigned to the movable belt conveyor unit.

From the feeder belt, at El. 453, all material is carried up a 24-per cent grade to the hog box, El. 654, by the main conveyor unit. The unit, 42 in. wide, is broken into three sections each with its own 150-hp. motor. Belt speed is constant at 500 ft. per min. At the discharge end of the first section is a shaker grizzly to remove stones 9 in. and over in size.

At the hog box, material from the main conveyor is transferred to a shuttle conveyor, 42 in. wide and 40 ft. long, which discharges through a two-way chute into the box compartment with a belt speed of 550 ft. per min. A movable baffle plate on the chute permits operation of either or both sides as desired. Originally the shuttle conveyor moved back and forth on tracks to distribute the material over the full length of the hog box, but soon it was found that the mixing in the box was satisfactory with the shuttle stationary and discharging into the high end of the mixing chamber.

Mixing and sluicing

The hog box, of timber construction on a concrete foundation, is 44 ft. long and 13 ft. wide, divided into two longitudinal compartments, one serving the upstream sluice line and the other the downstream line (Fig. 5). The compartment floors drop longitudinally on a 1:4 slope from El. 641 to El. 630. A ½-in. steel plate lines the compartments on the bottom and part way up the sides, above this is a lining of ⅜-in. rubber.

Clear water pumped from the core pool enters the rear of each compartment through a 3-in. nozzle and two 6-in. manifolds 8-ft. long supplying fourteen 1-in. jets each. Material falling from the shuttle conveyor is broken up by the jet action and becomes thoroughly mixed with the water before leaving the lower end of the compartments through a 36-to-20-in. reducer connected to the sluice line. A vertical bar grizzly prevents large stones from getting into the pipe lines.

The stream from the nozzle is directed parallel with the floor of the box and acts similar to a stationary monitor in breaking up the material. A pressure of 25 lb. per sq.in. is maintained at the nozzles and jets, and the quantity of water admitted to the box is controlled by hydraulic-operated valves. A booster pump at El. 640 is used occasionally to raise the pressure at the nozzles and to increase the velocity of mixed materials at the instance of the sluice lines.

The clear water is pumped from the core pool through a 28-in. pipeline to a 36-in. manifold at the hog box. The pumping unit consists of five electric-drive pumps, each delivering 4,200 g.p.m. at a 275-ft. head, mounted on a 26x68-ft. wooden barge. Pump intakes are set inside two tight sump boxes on each side

of the barge, their top edges set 6-in. below water surface to prevent disturbance in the pool. Normally, with only one sluice line in operation, the output of two pumps is sufficient to handle the material, though the quantity of water required varies with the type of material and length of sluice line.

The two 20-in. sluice lines totaling 5,400 ft. in length, are made up of 20-ft. steel pipe lengths. Some 3,400 ft. of the pipe is lined with ½-in. rubber vulcanized to the metal. The steel sections make up with slip-joint collars, while the rubber sections have bolted flange connections, the rubber lining being carried out and over the flanges to form a permanent gasket.

One side at a time

In general, practice has been to sluice one side at a time. Material is discharged from the end of the line and distribution is obtained by successively adding on or taking off individual sections of pipe. A 1-yd. dragline travels with the discharge end of the line, assisting in handling the pipe and building a levee from material picked up at the end of the sluice pipe. On the upstream side the dragline also places a blanket of selected coarse material. There is no interruption in the flow of material either in adding or taking off pipe. A series of baffle boards is used on the beaches to check velocities and to prevent scouring.

One-man job

The entire hydraulic operation is controlled by one observer from a station back of the hog box. This operator starts and stops all belt conveyors and operates the hydraulic valves. The control system is so arranged that if any one conveyor is shut down, all units feeding material to that section will automatically stop, thus preventing a piling up of material. Colored signal lights on a control panel indicate the stopping of any conveyor motor. In addition to the central control, there are emergency stop switches at every terminal along the conveyor. The control house is connected to all parts of the job by field telephone.

Sluicing operations are carried on continuously. At night the embankment is illuminated by lights on six towers, three on each beach. Each tower is equipped with twenty 1,000-watt floodlights carried 40 to 50 ft. above the fill. Borrowpits and yard areas are similarly lighted.

In order to create and maintain the core pool the contractor established a pump station on the river 500 ft. upstream from the dam, consisting of four pumps with a total capacity of 6,000 g.p.m. The make-up water is taken from the river and pumped through a 16-in. line to the pool. It is discharged into the pool at the extreme westerly end through a submerged floating stilling box which dissipates the velocity and keeps disturbances caused by adding water to the pool at a minimum. The box is equipped with adjustable pontoons which permit changes in elevations. The crest is usually kept about 1 in. below the surface of the water. A continuous flow of about 2,000 g.p.m. is necessary to maintain the pool at the elevation for proper operation.

Progress and direction

A total of 1,974,700 cu.yd. of material was placed during the 1937 season. The contractor has averaged 13,900 cu.yd. per day, and on Aug. 12 placed 23,000 cu.yd., the record for any one day. At the start of sluicing the pool level was at El. 412, and at the close of the season it had been raised to El. 470.

Rejects from the dry box and shaker grizzlies are being run through a crusher to supply crushed stone for riprap on the upstream face, but the bulk of the riprap is obtained from the spillway channel excavation.

The work is being done under the jurisdiction of the Metropolitan District Water Supply Commission of Massachusetts, of which Eugene C. Hultman is chairman; Thomas D. Lavelle and Edward J. Kelley are associate commissioners. Frank E. Winsor is chief engineer and Karl R. Kennison is assistant chief engineer for the commission. William W. Peabody is division engineer in charge of all outside construction and field work; the author is resident engineer at the dam. William H. Frantz, Jr., is general superintendent for the Foster Co.

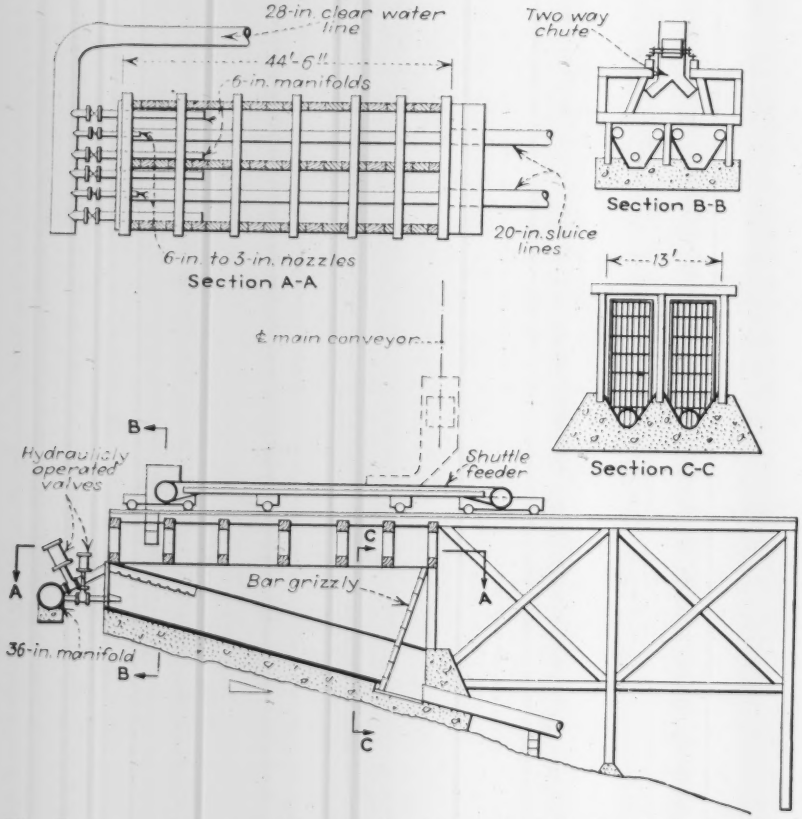


Fig. 5. Heart of the material processing is the hog box where water and dry materials are mixed for deposition in the fill.

Mine Sealing in Maryland

GEORGE L. HALL
Acting Chief Engineer, Maryland State Department of Health, Baltimore

Acid pollution of streams from bituminous coal mine drainage is being reduced by underground and surface sealing operations

WITH half of the 500 miles of streams in the coal mining sections of Maryland grossly polluted by acid drainage discharges, estimated to contain 77,000,000 lb. of sulphuric acid yearly, the state department of health in cooperation with federal agencies is actively engaged in a program of mine sealing. The work underway includes the construction of both underground air seals and surface water seals, the latter to prevent ground seepage from entering the underlying mine workings where it becomes contaminated. The work was started about two years ago with funds for administrative costs provided by the U. S. Public Health Service. Labor is supplied by the WPA and at the present time 75 workers are engaged.

Control of stream pollution caused by acid drainage from coal mines is one of the most troublesome problems faced by health and conservation authorities. The problem has many aspects involving not only the protection of industrial and domestic water supplies, but the corrosive effects of the acid mine water on structures and operating equipment in contact with the water. The destructive effect of the acid drainage on fish-life and game is likewise a major consideration.

As far back as 1924 studies were undertaken by the U. S. Bureau of Mines to determine the cause of sulphuric acid formation in coal mine drainage and to find a practical method for preventing it. It was found that the inter-action of air and water with the sulphur-bearing compounds exposed by mining operations resulted in the formation of acids in the following manner: Upon the admittance of air to the mine, the pyrites and marcasites are oxidized to ferrous sulphate and sulphuric acid, both of which are soluble in water. The ferrous sulphate is then oxidized to ferric sulphate in the presence of the acid. Finally, the ferric sulphate hydrolyzes with the production of iron hydrates and sulphuric acid. In view of the fact that air, water, and pyrites are all necessary for these reactions and that the absence of any one of the three will prevent acid formation, it was concluded that the exclusion of air would be the most practical method of control. These conclusions were then verified by tests.

To prevent the flooding of mines, they are sealed so that air is excluded yet water can flow unrestrictedly from them. This is accomplished by placing traps in the masonry seals in all wet openings, similar to the trap on a plumbing fixture. All other openings in the mine are then sealed to exclude the air. From these investigations two basic requirements of mine sealing were formulated:

(1) Construction of seals in all openings to exclude the air from the mine, but permit water to escape. This prevents oxidation of the sulphur-bearing compounds in the coal.

(2) Fill all surface cracks and crop-line breaks to keep surface water from entering the mine and thus reduce the volume of the mine drainage.

The first method is applicable only to abandoned or inactive mines. Abandoned sections of active mines can be satisfactorily cut off from the active workings, in many instances, thus reducing the total acid output from the mine. The second method can be used in combination with air sealing for active and partially active mines to reduce the volume of mine drainage.

TABLE I—COAL MINES IN MARYLAND

Basin	Total No. of Mines	Acid Load Lb. Per Year
Potomac River		
North Branch above Georges Creek	96	13,690,000
Georges Creek	170	16,470,000
Braddock Run	36	38,232,000
Jennings Run	79	6,930,000
	381	75,322,000
Ohio River		
Youghlogheny River	65	1,430,000
Casselman River	45	564,000
	110	1,994,000
Total	491	77,316,000

TABLE II—ACID PRODUCTION
From Active, Marginal and Abandoned Coal Mines and Drainage from Tunnels

Description	Total	%	Acid Production as Lb. per yr.	%
Active	188	38.3	23,190,000	30.0
Marginal	57	11.5	616,000	0.8
Abandoned	246	50.2	11,310,000	14.6
Midland Drainage Tunnel	...	....	520,000	0.7
Allegany Water Ditch	...	....	3,720,000	4.9
Hoffman Drainage Tunnel	...	....	37,960,000	49.0
Total	491	100.0	77,316,000	100.0

The problem in Maryland

In Maryland bituminous coal mining is centered in the two western counties, Garrett and Allegany. The mines, which total 491, are located in the drainage basins as shown in Table I.

In Table II is shown the distribution of the acid load contribution from active, marginal and abandoned mines and from the three drainage tunnels in the Big Vein area. The tunnels, which serve 12,833 acres of active and abandoned workings, contribute 54.6 per cent of the acid. The abandoned mines, of which there are 246, contribute only 14.6 per cent of the total yearly acid load. It is evident, therefore, that the major problem in controlling the acid mine pollution of Maryland streams is in reducing the acid in the drainage from these tunnels.

Of the 381 mines on the Potomac basin, 197 are abandoned, 30 are in-

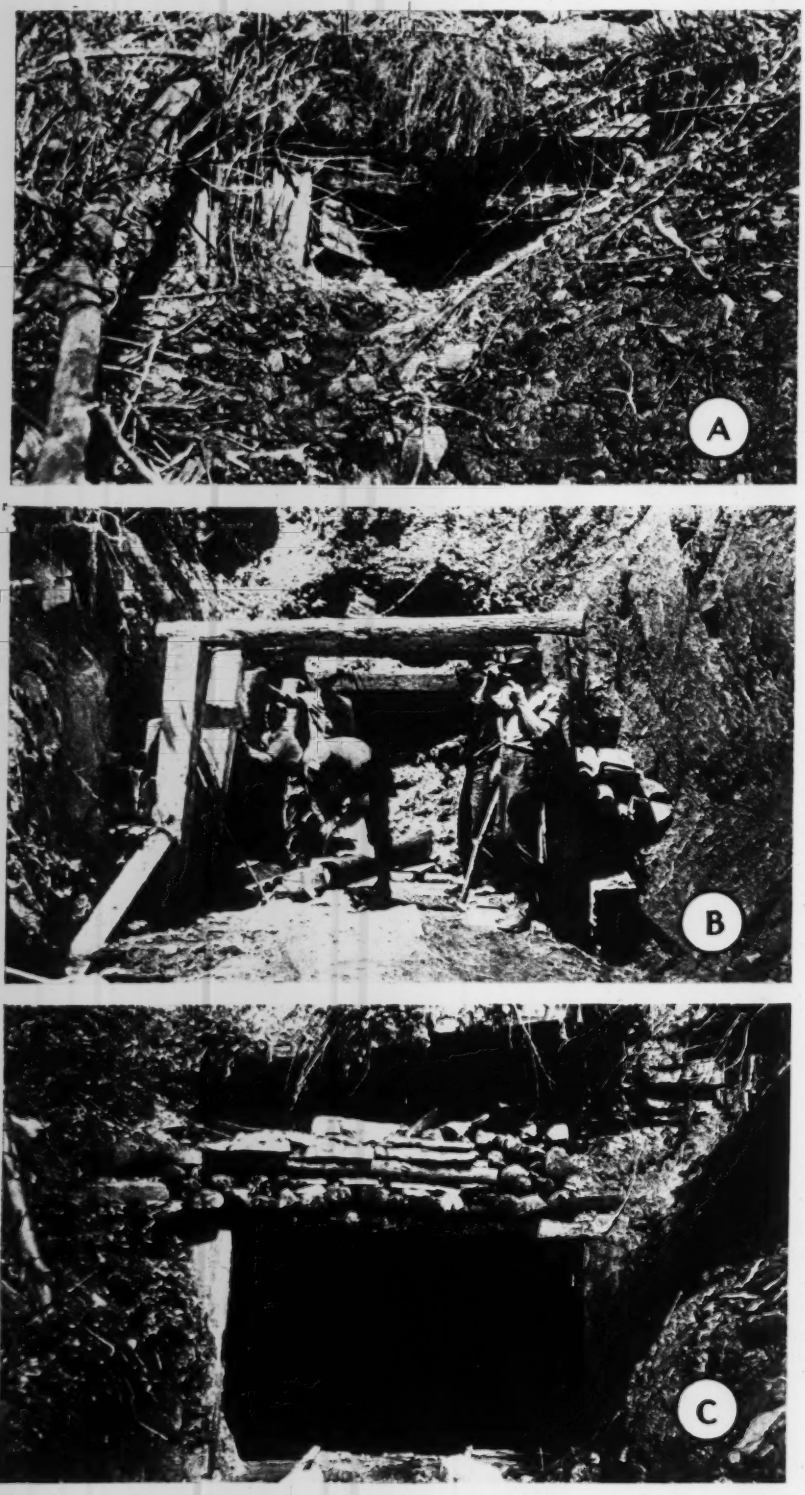


Fig. 1. Steps in mine-sealing: (A) Abandoned opening when preliminary inspection was made; (B) opening cleared and timber frame being placed to provide safe working conditions; and (C) completed timbering prior to construction of the masonry trap.

active at the present time, and 154 are active, while on the Ohio basin there are 110 mines, 49 of which are abandoned, 27 inactive, 34 active.

Sponsored jointly by the U. S. Public Health Service and the state department of health, sealing operations with WPA funds have been underway since November 1935. Prior to this time mine sealing was undertaken with the cooperation of the CWA, beginning in December 1933. Very little was accomplished at that time as the project was terminated in March 1934 before any construction was done.

Under the present arrangements the administrative costs are financed by the U. S. Public Health Service. The administrative personnel consists of a state director; assistant state director, who is a skilled mining engineer in charge of field operations; assistant engineer and chemist; and an accountant and clerk.

Work accomplished

All mines in the state have been inspected and reports prepared for each one, together with cost estimates for sealing the abandoned mines. Samples of drainage have been collected from each mine and the flow measured to determine the total acid produced. In cases where the cost of constructing seals is not excessive, based upon the amount of acid produced per year, the mine openings are closed after permission has been obtained from the owners. Sampling stations have been established on the streams in Garrett and Allegany counties receiving mine waste and a regular sampling schedule is in effect for the purpose of checking results accomplished by the sealing operations.

Up to December 1937, fifteen mines with a total of 52 openings were sealed. As a result the observed acid production from these mines has been decreased 72 per cent. In a few recently sealed mines acid production has increased. Inspections have shown that air is entering through cracks in the closed openings which resulted from falls and breaks occurring over the seals.

Surface sealing

Studies of the seasonal variation in the volume of drainage from the Big Vein area indicated that surface sealing of crop-line breaks, surface cracks and other openings, would prove effective in reducing the acid content. It was observed that in rainy weather large increases occurred in the volume of the discharge from these mines due to the entrance of surface water through crop holes and

Fig. 2. A surface sealing project in which a stream bed has been cleaned, paved and provided with a retaining wall to prevent overflow into surrounding cracked ground.

Fig. 3. Flume construction across a surface break to prevent water infiltration.

other surface openings. These breaks are caused in most cases by pillaring out the coal. The resultant settling of the mine roof causes cracks to occur in the overlying strata. The filling of these surface openings and the paving of the stream beds over the surface cracks is now underway.

The work consists of sealing the surface cracks, paving the stream beds where cracks exist and building dry masonry retaining walls backed with clay to prevent the streams from leaving their courses during times of high water and overflowing the adjacent land where many of the surface holes are located. Observations after this work has been completed, show that there is a large increase in the flow of these streams, indicating that the water formerly entering the underlying mines is now restricted to the normal channels.

Mine operators, too, note the benefits of these improvements. In the past during heavy rains on one of the stream basins the water was knee-deep in the underlying mine, but since the surface cracks have been sealed and the stream-bed paved very little water enters the mine.

It is yet too early to fully determine the benefits of mine sealing, since only 246 mines, or 50 per cent of the total, are abandoned. These abandoned mines produce 11,310,000 pounds of acid or 14.6 per cent of the yearly mine acid load of 77,316,000 pounds of acid. The three drainage tunnels contribute 42,200,000 pounds of acid, or 54.6 per cent of the total production. The problem, therefore, after the acid-producing abandoned mines have been sealed, is to determine what can be accomplished by underground sealing of the abandoned sections of those areas drained by the three tunnels and to develop a method of reducing the acidity of the drainage from active mines.

No studies have been made in the mine sealing project to determine the extent of the acid pollution of streams from the large culm banks which necessarily exist at all coal mines. Studies should be undertaken, however, to determine whether the intermittent drainage from these sources is a major contributing factor.

Although a concerted effort is being made in the Maryland mine sealing project to reduce the acid pollution of the receiving streams, it must be realized that this work is limited to the drainage from the abandoned mines and worked-out sections of some of the active mines, and to surface sealing. Concerted efforts of the mine owners in cooperation with governmental agencies, are essential, therefore, to further control acid pollution of the streams from active bituminous coal mines.

The author is State Director of the Mine Sealing Project in Maryland and S. Graff Haverstick is Assistant State Director.

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Drainage District Need Not Pay Engineers

THE CIRCUIT COURT of Clark County, Mo., on April 5, 1932, awarded the engineers employed by the Mississippi and Fox River Drainage District of Clark County a judgment for $6,000 fees with interests and costs. The district being without funds at that time, the judgment creditors brought suit for a mandamus order directing the district drainage commissioners to levy a tax against lands in the district to pay this judgment. Petition was denied.

An appeal was taken by the engineers to the Missouri Supreme Court, which ordered the case tried by the St. Louis Court of Appeals, March 17, 1937. This court denied the order for mandamus on Jan. 4, 1938, as the court found that the district could not levy such a tax.

The legislative enactment authorizing this district, which was formed in 1915, provided for a tax of 50c. per acre to pay organization expenses. This tax had been levied at that time and expended. The present claim for engineering fees is based on a supplementary plan which added several hundred acres to the original area of the district and required a new set of engineering plans, specifications and added construction work. The engineers claimed that the judgment became a debt of record against the district, but the court adopted the rule that the engineers were under the disability of the presumption that they dealt with a quasi-municipal corporation of limited powers. (Bushnell vs. Miss. & Fox R. Drain. Dist., Mo. 111 S W (2) 946; St. Louis, Mo. Ct. App. Jan. 4, 1938; transferred from 102 S W (2) 871; Supreme Ct. Mo. March 17, 1937.)

Rejuvenating Old Pipe

Steel pipe is strengthened by a protective concrete jacket placed by a special machine

SEVERAL steel pipe lines in Southern California have been given a protective encasement of concrete applied by means of new methods and equipment which function without requiring removal of the pipe line from the trench or even taking it out of service. Typical of what the new methods accomplish is the jacketing of a 16-in. riveted steel pipe on the Los Angeles water system in the San Fernando Valley which had become so badly pitted that early replacement of about 500 ft. of the line seemed probable. This line was built of fairly thin metal (0.134 in.) and operates under a pressure of 70 lb. per sq. in. The 500-ft. length was encased by the new method about a year ago with what water department officials found to be "a concrete jacket of superior quality." Repeated examination of the line in the ensuing 12-mo. period showed no indication of leakage, and the line is now reported to be in excellent condition.

The operation begins with exposing the pipe in the trench and cleaning the metal surface to be covered. The concreting machine then is fitted over the pipe, concrete is fed into a hopper and the machine advances itself along the line, extruding the concrete jacket as it goes. The concrete completely encases the pipe, against which it is compacted by rotating lugs or blades of spiral shape.

How the machine functions

The concreting machine is a simple mechanism consisting essentially of a light rectangular steel frame which fits over and is supported by the pipe. Adjustable equalizing dollies guide the advancing end of the machine. The frame carries a 3-hp. gas engine which through a short shaft with universal joint, clutch and chain operates a rotating steel drum surrounding and concentric with the pipe. To the rear end of the drum are bolted the bases of steel lugs which extend as spirally curved cantilevers around the pipe surface. The lugs are enclosed within a sheet-steel housing which also encircles the entire pipe and on its upper surface connects with a feeding hopper. Thus the lugs revolve within the annular space between the pipe and the housing.

As plastic material is fed through the hopper upon the pipe surface and between the curved lugs which operate around it, rotation of the lugs forces the concrete toward their free ends and in so doing builds up a pressure which increases until the entire mechanism rolls along the pipe away from the compacted concrete. The speed of machine travel is an automatic and direct function of the rate at which material is fed into the hopper. The result of advancing the machine along the pipe is that the end of the housing or throat leaves behind it a finished concrete encasement which has been compacted and firmly pressed against the entire pipe circumference. The rotating blades remove any entrapped air and perform part of the compacting function. Further compacting as well as finishing of the surface results from forward movement of the circular throat.

Counterweights maintain the machine in an upright position on the pipe; the guiding dollies are adjustable so they can be adapted to the particular job. Lug and housing design is varied to permit a range of encasement thickness from $\frac{5}{8}$ to 2 in. or more. For pipe sizes up to about 24 in. the weight of the machine without counterweights does not exceed 400 lb.

Practicable limits for speed of travel are 1 to 4 ft. per min. depending upon size of pipe and thickness of coating. Several sizes of extruding ends can be used on the same frame; hence a wide range of pipe sizes can be jacketed by a single frame with its motor-drive. The over-all width of the machine need not greatly exceed the diameter of the pipe; for pipes of small diameter trenching costs are kept down by using small power units.

The 16-in. pipe encased in the San Fernando Valley was a trial contract. A lump sum price of $2.45 per lin. ft. for the 500-ft. length to be treated was agreed upon and this was to include the following operations: excavate trench and place skid supports beneath the pipe; clean the pipe; calk all leaks; place a 1½-in. reinforced-concrete jacket; spray the fresh concrete with a sealing compound, and backfill. Although conditions generally were favorable to low unit costs and no unusual difficulties were encountered, a number of the operations were experimental and hence warrant description.

Cleaning was done with an Adams cleaning machine, a mechanism which rides the pipe and by means of a small motor drags a chain with cutting fingers rapidly around the pipe circumference. With this equipment practically all products of corrosion were removed from the pipe and from around the rivet heads without injury to the metal. Obviously such a process would not clean out deeply pitted areas, as could have been done with a sandblast. However, it was agreed that in bady pitted areas the entire surface need not be cleaned down to clear metal. It appeared that very thorough cleaning of badly pitted sections might induce additional leaks and weaken the pipe to such an extent that replacement rather than jacketing would be required.

Experience with leaks

In the process of uncovering the pipe, setting it on skids and cleaning all loose material from its surface considerable leakage developed. Leakage was of three kinds, (1) from the unwelded slip joints; (2) from pitting that had gone entirely through the metal, and (3) from riveted joints, where the seepage was best described as "sweating."

All the visible-flow leaks were stopped with calking; if the flow was so small that it did not threaten disturbance of the concrete jacket prior to final set no effort was made to stop it before placing concrete.

AVERAGE COSTS ON PIPE LENGTHS EXCEEDING ONE MILE
(Assuming reasonable favorable working conditions)

Pipe Size (inches)	Minimum encasement thickness (inches)	Cost per lineal foot — Plain concrete (cents)	Reinforced concrete (cents)
4	¾	17	19
6	⅞	25	28
8	1	34	39
10	1⅛	44	50
12	1¼	54	62
14	1½	64	74
16	1⅝	74	86

Thus many slight leaks were left dependent for permanent stoppage upon the tightness of the concrete.

The problem of how to support the pipe line on the fresh concrete after the machine had passed did not prove as difficult as was anticipated. A separate crew of three men assigned to this part of the work slightly raised the line just ahead of the advancing machine to permit removal of the skids as the machine approached them. To take the place of skids so removed new points of support were used immediately behind the machine. At such points several layers of heavy-waterproof paper were tightly wrapped about the concrete to protect the fresh concrete surface.

After this wrapping, the pipe was lowered slightly to rest in a wooden cradle whose inner surface was shaped exactly to fit the under half of the wrapped circumference. These carry the pipe without any indication of disturbance of or injury to the concrete surface. Cradles were spaced about 12 ft. apart.

The concrete mix was 1:1:2; pea gravel constituted the coarse aggregate. The cement used was standard rather than quick-hardening because the ultimate advantage of slower hydration was considered more important than the gain of early strength. Five gallons of water per sack of cement was used.

Novel wire reinforcement

Short lengths of crimped high-carbon steel wire were added directly to the concrete mix, at the rate of about 2.12 lb. of 14-gage wire in 3-in. lengths per lin. ft. of the coating. The operation of the lugs distributes the wires quite uniformly in a generally circumferential direction. The overlapping was estimated to be greater than 30 diameters, indicating about the same strength as in continuous, spirally wound wire with average spacing less than 1 in.

The amount of wire used averaged more than one strand to each sectional square inch of the jacket. This gave the concrete tensile strength, which is an advantage when encasing weakened or lightweight steel pipe. The wire also increased resistance to checking and cracking. However, wire is not a prerequisite to success of the process.

Because the trouble with this particular pipe line had its origin in pitting, consideration was given to the possibility that some wires in the reinforcing might not take their intended circumferential position and might establish a metallic path through the protective jacket. Careful inspection of the jacket showed no wire exposures of this sort, and it is believed that they ordinarily will not occur.

Particular care was taken to spray a seal coat over the freshly placed concrete *immediately* after the machine had passed. This was found necessary because even a few minutes exposure to hot sunshine tends to cause too rapid shrinkage and contraction. This is an added reason for using the slower-hardening cement.

Subsequent to completion of the San Fernando job, experience gained in encasing steel pipes for oil and water service gave additional information on costs which was used as a basis for an average cost estimate for pipe lengths of 1 mi. or more given in the accompanying table.

The concreting machine was invented by Thomas H. Wilson and developed by Sterling C. Lines, consulting engineer, Los Angeles.

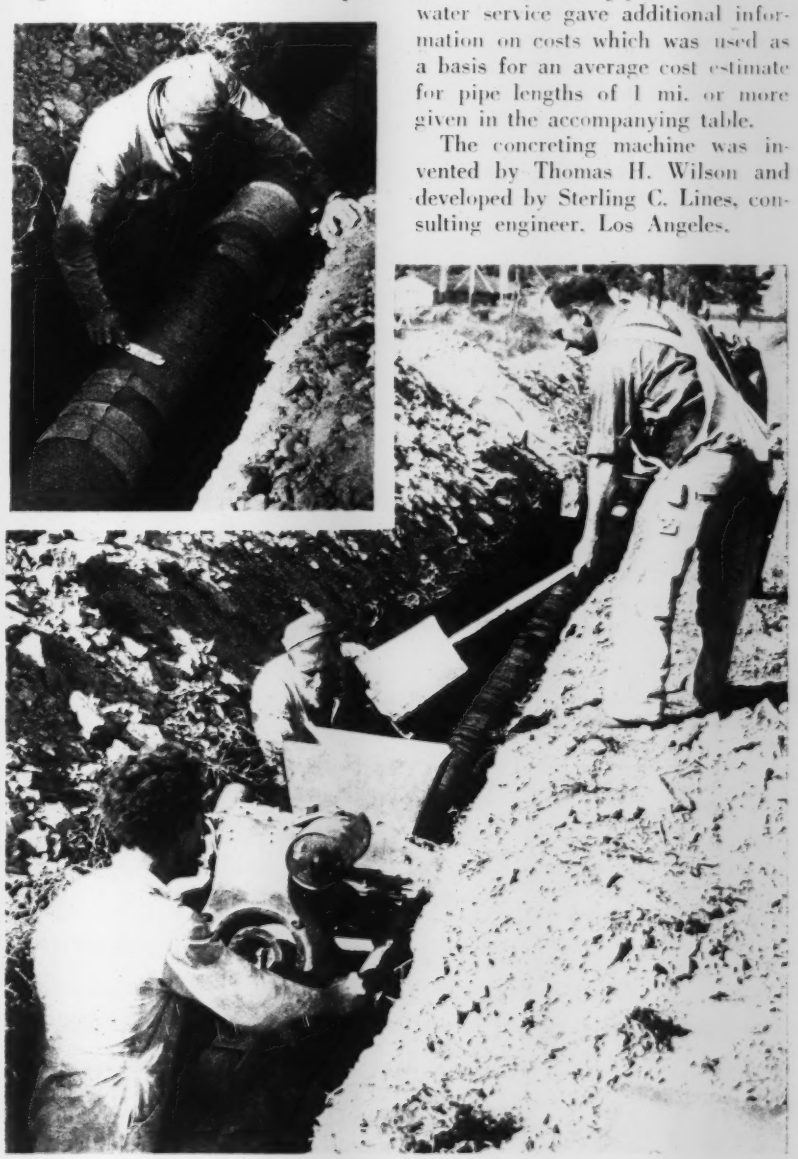


Fig. 1. The machine moves along the pipe under pressure built up in the concrete by the rotation of spiral lugs within the machine. (inset) The concrete jacket, while still very fresh, is tightly wrapped with paper at the points where it must be supported on temporary cradles.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Split Header for Paving

R. H. Wood
Kansas Highway Department,
Cottonwood Falls, Kan.

The sketch illustrates a method of heading the day's run of concrete pavement without cutting off the wire mesh and steel center strip.

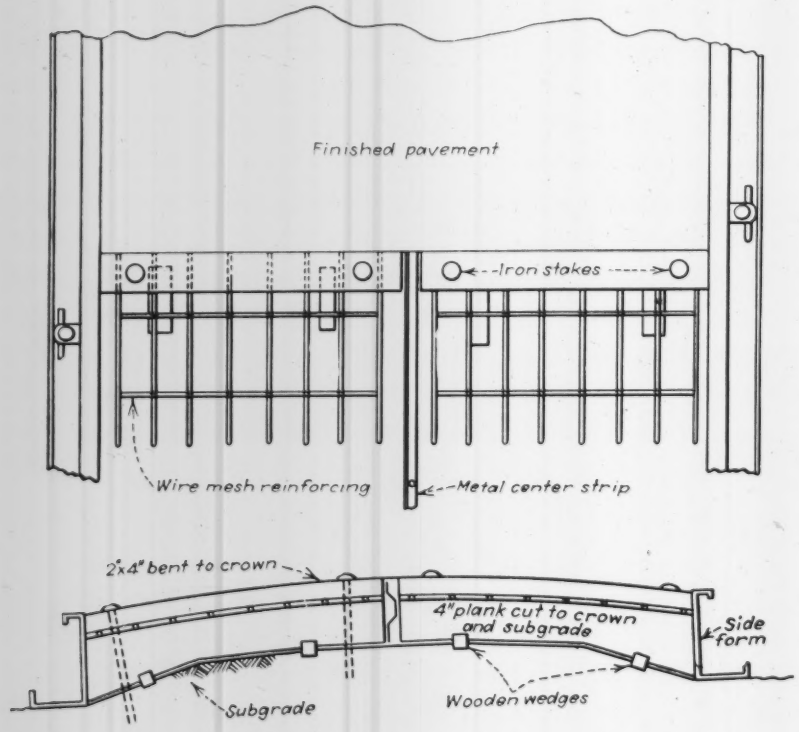
The principal parts of the header are the bottom boards. These should be made of 4 in. lumber, cut to fit the subgrade on the bottom, and finished to the exact shape of the crown on top. Where the mesh is placed 2 in. from the top, the bottom boards should be made 2½ in. short of the top of the slab.

The bottom boards are placed under the wire on each side of the center strip. A 2x4-in. strip is placed flat on top and pulled down snugly to the wire by iron stakes. The top pieces will assume a smooth curve in the true shape of the slab crown. The stakes are driven through holes bored in the header and should penetrate at least 8 in. into the subgrade. The small rounded heads of the stakes caused the finishers no trouble.

After being assembled in place the header can be adjusted to exact grade by wooden wedges driven under the header. The usual dry paving mix does not leak appreciably through the gaps in this header.

This type of construction joint is superior to the common key type joint in that it will not open up when the slab contracts and is not subject to corner failures in the center due to the strip being cut and the ends offset or running at an angle to the slab. It also permits the reinforcing to come out even at the next expansion joint.

The author has examined many construction joints in pavement which were headed off both by cutting the wire mesh and by the above method. Even in winter no construction joints made by the above method were found open enough to admit a knife blade. Other types of construction joints were found contracted as much as ¼ in. and showing evidences of subgrade instability due to the free entrance of water at the joint.



Split header avoids cutting reinforcement or steel strip for the center joint.

Brief Memoranda

Leather shoulder straps with red reflectors will blink warning to traffic at night that maintenance workers of the Pennsylvania Department of Highways are working along the road. The department will fit 750 men with the belts as an experiment. The belts, of the Sam Brown type, have two 3-in. reflectors which can be adjusted into any position to reflect the lights of oncoming traffic. In addition, the shoulder straps have two 1¾-in. reflectors. If proven satisfactory, the department plans to distribute 5,000 of these belts to protect men engaged in cindering operations and other emergency work at night.

A heavy algae growth in Silver Lake in the Los Angeles water supply system was successfully destroyed by scattering 6 tons of calcium hypochlorite (35 per cent chlorine) in dry form. A new type of dry copper-sulphate scatterer covered the 90 acre reservoir containing 2,300 acre-ft. in 8 hr. W. W. Hurlbut says residuals of 0.6 ppm were maintained for ½ hr. Some fish were killed.

Due to complaints received from consumers on the quality of water received through new services, the Los Angeles Bureau of Water Works and Supply is conducting a corrosion test on different types of water-service materials. Eight lines of galvanized copper, steel and brass pipe in various combinations typical of service installations, and in 50-ft. lengths, some of which are insulated, are intermittently operated on a metered sampling schedule. Chemical analyses determine accurately all metallic changes as well as deterioration of sanitary qualities.

Most laboratories equipped with standard autoclaves and oven sterilizers are unable to meet requirements of "Standard Methods of Water Analysis." Sterilizers in general require 45 min. or more to effect sterilization of lactose broth, even though it is only 15 min. at its top temperature. "Standard Methods" recommend that sterilization be completed within 30 min. to prevent lactose being converted to dextrose with subsequent spurious results. The Los Angeles water-works laboratory has a specially designed electric autoclave which sterilizes 15 min. at 15 lb. pressure with 25 min. as the maximum time during which the media is hot. Special features include a reserve steam jacket for quick heating, a Pauli automatic ejector to remove air and water, and a recording thermometer.

Hot-air ovens are universally faulty in permitting untreated outside air to enter

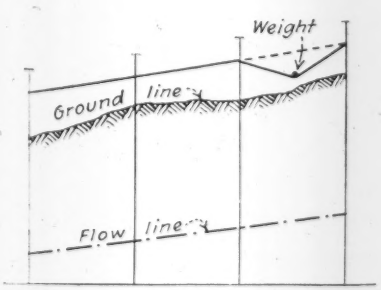
the oven during its cooling period to correct for shrinkage in volume which ordinarily amounts to the introduction of about one-third new air. Also, tight ovens require a long time for cooling. Two electric ovens, each with Lindberg controls, were installed in the Los Angeles water works laboratory, says W. W. Hurlbut, with a 2 cu. ft. air sterilizer chamber with ribbon elements at 1,000 deg. F. temperature to sterilize all air entering the oven during the cooling period and were further equipped with a water cooling system so that a closed hot oven could be cooled automatically to room temperature in 15 min. time.

Keeping Grade Line Taut

GORDON DINSMORE
Topeka, Kan.

Some time ago the writer had charge of a piece of sewer construction, as engineer and inspector. On a frosty morning in late fall the line had been tightly stretched over the batter boards and the pipe laying was going forward at a rapid rate. The line was damp and frost-covered. The sun rose higher, melted the frost and dried the line. Before anyone realized what was happening, the line had sagged, and several lengths of pipe had to be taken up and relaid.

To prevent the recurrence of this annoyance, the line was again stretched and 3-d. nails driven into the batter boards (each side of center) so that the line could move lengthwise between the nails. A weight was placed on the line midway between batters, at some section forward or back of where pipe was being laid. This not only stretched the line to almost absolute straightness on all the other sections but automatically took up any slack, due to tension, that might occur later. If a board or pole be used to lay across the line, care should be taken to have it of such weight that only one end rests upon the ground; so as to bring continual tension on the line.



Sag of grade line prevented by a tightening weight.

Indianapolis Water Co. finds that this arrangement helps consumers who cannot come to the office in the daytime, or wait in line, to pay their bills.

For Late Bill Payers

Following the practice of banks in providing for the receipt of deposits after hours the Indianapolis Water Co. has also provided facilities for receiving payments after hours. Inside the office vestibule, always open, is a chute leading to a vault in the basement. Small envelopes are made available in which the customer may seal his bill and cash to be inserted into a mail box opening leading to the chute. A pencil on a string and a small shelf completes the facilities for payment.

Many consumers who are without bank accounts or who cannot easily leave their jobs during office hours find the arrangement most accommodating. As parking is restricted in front of the office patrons find the night payment box convenient for day payments when the cashier's window has a line in front of it. The public relations department puts out a blotter publicizing the arrangement.

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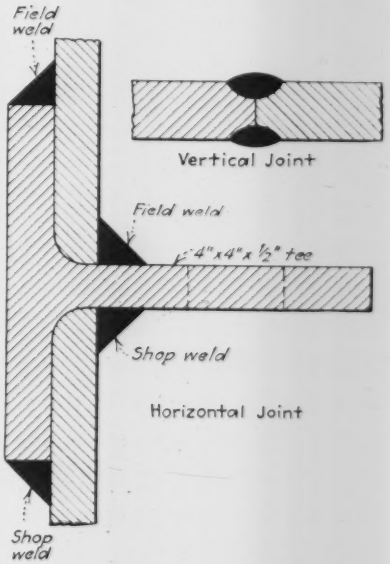
New Type of Weld For Steel Stack

T-welds (see sketch) were used instead of butt lap welds for the first time, it is believed, in constructing an all-welded steel stack for the Fisk St. generating station of the Commonwealth Edison Co., Chicago, Ill. The stack, 219 ft. high and 13 ft. 10 in. inside diameter, is of soft steel lined with vitreous shale brick laid in portland cement mortar. The steel shell was built up in 7-ft. high rings made up of three curved plates. The sketch shows the vertical and circumferential joint welds; note that the stem of the T forms a circumferential ledge to support the brick lining. The shell sections were handled by a derrick on a floating scaffolk with 6-point suspension instead of the usual 4-point. This was a safety measure; with the 6-point suspension, if one of the points gave way the scaffold would remain in position. As a result there were no accidents of any sort during construction.

Arc welding equipment was used and welding was chosen because it eliminates caulking, promises minimum corrosion and costs slightly



Welded joint details for a steel stack

less than rivetting. Erection was started April 9, the steel was up June 25 and the stack was put in service July 29, 1937. The contractor was Henry Pratt Co., Chicago. Sargent & Lundy, Inc., Chicago, were the consulting engineers on the job.

Some California Engineering

Comments on work and practices transcribed from an editor's travel notes from San Francisco

LAST WEEK these notes on California engineering were concerned with work in the Los Angeles area. But Los Angeles is only a part of California, and to San Franciscans not the most important part. They have their great bridges to point to with pride and Treasure Island, where the Golden Gate Exposition buildings are taking shape, to look at with great expectations.

The Bay Bridge, operating smoothly for 25,000 motor vehicles a day, is still in the construction stage for railway service. Placing of the 105,000 redwood ties and other trackwork is the principal operation on the bridge proper. In Oakland, the elaborate electric car storage yard is approaching completion, as is the Port of Oakland overhead highway with its connecting ramps. Trains are scheduled to begin operation over the bridge next fall.

Directing sign practice on the bridge and approaches is impressive. Simplicity and size are the keynotes. By most standards, the letters, formed by reflector buttons, are huge, and signs contain at most three words and an arrow. The common urge of signmakers to write a message to the motorist has been successfully overcome, and traffic movement is greatly improved thereby.

Another point of activity on the Bay Bridge is at Yerba Buena Island, where connecting roads are being built to carry Exposition visitors to the dredge-built Treasure Island. The turnouts from the Bay Bridge viaduct are of small radius and will cause some traffic congestion, but no better solution is available since the idea of a Fair had not been broached at the time the bridge was designed and no provision was made for connecting roads.

Attractive and economical columns for supporting the railway catenary and for use as light standards have been developed by the Bay Bridge engineers. They are simply H-sections with the ends of the webs split and spread to form prongs which then are bent to any shape desired. Also in the rigid frame bents adopted for the framing of the railway terminal building in San Francisco, (Fig. 1) the "split and spread" idea is utilized at the tops of the columns to form the curved knees.

On all of the Bay Bridge approaches unusually heavy galvanized pipe railing—8-in. posts and 6-in. rails—is used on top of high curbs. The effect is good psychologically, because the large pipe suggests safety, but the size of the pipe, in turn gives the railing a stubby and rather unpleasing appearance.

Something new in bridge painting has been tried on the Golden Gate Bridge, where the towers and stiffening trusses have been painted a bright red. There are a number of theoretical reasons for the red color, among them the red rocks of the Marin County hills in the background, a greater visibility in fog and a symbolic connection with the name of the site, "Golden Gate," but in the final analysis it is probably advertising value that carries the most weight.

Painting of huge structures like the Golden Gate Bridge is a continuous maintenance job, and the operating engineer on the bridge has designed and just completed the installation of permanent movable scaffolds or platforms hung from the lower chords of the stiffening trusses to furnish easy and safe access to the steelwork beneath the deck.

The present north approach road to the Golden Gate Bridge rises to an elevation several hundred feet above the bridge, a climb that is uneconomic from the point of view of motor vehicle operation, and there is some talk of constructing an alternate low-level route which would follow the shoreline around the hills and through the town of Sausalito. This route would eliminate the climb to above bridge deck level and would also be less subject to slides, which have caused difficulty in the deep cuts on the approach.

Fig. 1. Rigid frames in the terminal building of the Bay Bridge rail line in San Francisco.

State bridge practices

In Sacramento, in the spacious new offices of the state highway department, one hears of the same problem that besets other states—the difficulty of planning and building the facilities that are needed with the funds that are available. The difficulty is going to be particularly real for California bridges this year because damaged structures will require money that had been allocated elsewhere.

Because bridge money has to be spread over such a large territory (only Texas is larger) and because some of the bridges necessarily must be big and expensive, a premium is placed on economical design practices. Particularly noteworthy is the use of "floating" abutments at the ends of continuous span bridges. These abutments are merely slabs placed directly on the ground at shallow depth and allowed to settle as they will, with the idea that they can periodically be jacked back to proper elevation. Such economical abutments are made possible by the use of short simple-beam spans, one end of which rests on the abutment while the other end is hinged to a cantilever extension of the contin-

uous bridge. Such abutments have been used on continuous girder, rigid-frame and arch bridges.

Another economy is practiced by using redwood posts and rails for guard rails and bridge railings on all but the most important highways. Redwood is cheaper than concrete or steel and, unlike some other kinds of wood, does not splinter badly when broken. The guard fences along fills consist of a series of posts, without rails, the theory being that, while they will shear off when struck, they will reduce a car's speed and perhaps stop it before it goes off the road.

Still a third economy is being effected by reducing all unnecessary ornament and detail on bridges. Such "streamlined" design also produces a new type of esthetic effect. A notable bridge conforming to this theory is under construction at Red Bluff across the Sacramento River. The 60-ft. concrete piers have perfectly plain surfaces. The seven 115-ft. plate girder spans (continuous over the piers, with suspended center portions in every second span) have constant depth. Finally, a steel railing of flat horizontal bars is used, with no change in post type or spacing at the piers. The only break in the smooth unadorned surfaces occurs at the piers, where the 10-in.-pin shoes are made specially prominent to emphasize their function. Lighting will be by modernistic sodium vapor units. W.G.B.

Consolidation in Canada

Engineering Institute and provincial professional associations take initial steps toward unifying the technical and professional activities

THE FIRST definite step in a program for consolidating the technical and professional activities of engineers in Canada has been taken by the Engineering Institute of Canada. By a large majority, members of the institute have approved a by-law which gives the council of the institute power to "cooperate with any association of professional engineers constituted by an act of any province of the Dominion of Canada in furtherance of the mutual interests of the members of the institute and of the association." To this end the council may enter into an agreement with any association covering certain specified objectives, which agreement before it becomes effective must be published in the *Journal* of the institute, must be approved by a two-thirds vote of the institute council and by a majority of the corporate members of the institute resident within the province concerned.

First agreement published

Simultaneous with the announcement of the favorable vote, there was published in the *Journal* a proposed agreement between the institute and the Association of Professional Engineers of Nova Scotia, thus initiating the action necessary to give effect to the new by-law.

The proposed agreement is the result of joint work on the part of representatives of the institute and of the Nova Scotia association and was prepared in anticipation of favorable action on the new bylaw. It has been approved by executives of the two branches of the institute in Nova Scotia, hence its approval by resident members of Nova Scotia appears assured.

The agreement now under consideration is designed to effect: (1) a common membership of the institute and association; (2) simplification of existing arrangements for fee collection; (3) a reduction in the combined fee payable by those who are now members of both organizations. To this end, it is provided that:

(a) All members of the association, at the time the agreement goes into effect, who are not then members of the institute shall automatically become corporate members. All those over the age of 35 shall be assigned to the grade of members and those under 35 to that of associate members, the latter being elected full members automatically as soon as they become 35.

(b) Engineers who register with the association after the agreement goes into effect, shall become members of the institute in the appropriate classification under the institute by-laws, subject to review in the case of any engineer over 35 who is dissatisfied with an election as associate member.

(c) In lieu of the ordinary institute fees, the association agrees to pay to the institute the sum of six dollars for every full member, and five dollars for all other members of the association. (These sums are about one-half of those now paid by members of the institute resident in Nova Scotia). This payment will entitle all the association members so covered to full privileges of institute membership, including the subscription to the *Journal*. Thus the fees of all engineers in Nova Scotia will in future be collected by the association, eliminating duplicate fee collection. Also, the fee will be less than the present combination.

When this agreement goes into effect all registered engineers in Nova Scotia (all engineers recognized in law), will be members both of the association and of the institute. No provision is included, however, for the reverse provision, i.e., that all members of the institute in Nova Scotia will be, or will become, members of the association. This constitutes the main difference between the agreement now under consideration and the proposals which were defeated last year.

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Water Wheel Capacity Rises One Per Cent

AFTER a jump of 6.5 per cent in 1936, the total installed capacity of water wheels in water power plants in the United States increased one per cent in 1937, according to a report of the Federal Power Commission. The total capacity in plants of 100 hp. or more in the United States on January 1, 1938, was 17,284,379 hp.

A.W.W.A. Meets in New Orleans

Report of the technical sessions dealing with water treatment and management problems

The first half of the report of the American Water Works Association convention was published in last week's issue. This is the concluding installment of the technical discussions. EDITOR

THE USES of carbonaceous zeolites, which have a number of new applications to water softening, were described by S. B. Applebaum, vice-president of the Permutit Co., N. Y. This type of zeolite is manufactured from carbonaceous material such as coal, given special treatment with chemicals such as sulphuric acid or sulphur trioxide, and then washed, stabilized and screened. It is black, hard and granular.

When regenerated with sodium chloride, a carbonaceous zeolite operates as a typical sodium zeolite. It has a capacity of 5,000–8,000 grains of calcium carbonate removed per cubic foot. The granular sizes are large and it can handle high flows (6 to 8 g.p.m. per sq. ft.) with very low loss of head. Because the material is completely resistant to acid, it can be regenerated with acid to form hydrogen zeolites. Its capacity is then 8,000 to 9,000 grains of cation per cubic foot when regenerated with 2.25 to 3.0 pounds of acid.

Hydrogen zeolite was said to present a new method for municipal water softening, combining the advantages of lime softening, which reduces alkalinity with the advantages of zeolite softening, which removes the hardness without production of any sludge. The hydrogen zeolite is particularly effective in the removal of sodium bicarbonate in the course of which it converts the bicarbonate to carbonic acid; heretofore the only method was distillation. In waters containing calcium and magnesium bicarbonates it converts the carbonate to carbonic acid and thus not only removes hardness but is effective in removing alkalinity as well.

Chlorine used in conjunction with ammonia is rapidly becoming an important and extensively used type of treatment, according to F. W. Gilcreas, state department of health, Albany, N. Y., and chairman of the chloramination committee. Based on data from 40 states, it was reported that 3,372 supplies are treated with chlorine, and about 16 per cent of this number are also applying ammonia. The ratios of chlorine dosage to ammonia use, varies from a maximum of 1 to 1 to a minimum of 12.8 to 1, and averages 3 to 1.

A final report on tests and specifications for activated carbon was submitted by the chairman of the committee, M. M. Braidech, Case School of Applied Science, Cleveland. In the form of a monograph encompassing information on the manufacture, use, methods of test, specifications and basis of payment, the report will be printed and distributed.

Little progress was reported by the committee studying the relation of gastro-enteritis outbreaks with water-borne infection. Chairman George Norcom, consulting sanitary engineer, Federal Water Service, New York, stated that cooperative investigation has been arranged with the American Public Health Association in order to enlist the aid of medical research. He said that there is no reason at present, however, to conclude that existing standards of water quality are inadequate under normal conditions.

Double-cone precipitators

Features of the new lime treatment softening plant at Minneapolis using the double-cone type precipitators developed by Charles Spaulding at Springfield, Ill., were described by J. A. Jensen, engineer of the Minneapolis water department. The plant, now under construction, will have a capacity of 10 m.g.d. and will employ 12 precipitators which are designed to serve as combination mixing, coagulating and settling tanks. Each precipitator includes an inside truncated cone with the small end at the top, outside of which is another truncated cone with the larger end at top. Water dosed with lime enters the inside cones, passes downward where it is mixed by paddles and then rises upward through an annular slot. A sludge cloud forms at this place and this aids in completing chemical reactions for precipitation.

The usefulness of clay in water purification was described by Paul Weir, superintendent of filtration, Atlanta water department, who stated that: (1) in conjunction with regular coagulents it frequently hastens settling; (2) aids in the reduction of certain tastes and odors as well as coloring matter; and (3) exerts certain zeolitic effects on many hard waters. It was further pointed out that since clay is inert toward the chlorine it absorbs, it has a tendency to reduce putresence when deposited in the sludge area of sedimentation tanks. Experiences at Atlanta indicate that where clay is applied in raw water, and carbon is added to the settled water, the two become complementary in action. Thus, the combination improves coagulation and reduces taste and odor more effectively than when either is used separately.

Experiences with activated carbon application at Richmond, Va., where it is fed directly in the filters, were discussed by Marsden Smith, engineer, bureau of water and electricity. The filter runs often exceed 300 hr. but when organic growths tend to shorten this period increased dosages of carbon materially multiply this effect. Due to all-around good results with an average carbon dose of less than 5 lb. per million gallons it is economically feasible to apply carbon all the time. Repeated tests have shown that when carbon is applied before coagulation it requires more than ten times as much carbon as when applied directly to the filters. Carbon is applied in batches at Richmond, just before refilling the filter after it is washed.

In discussion, John R. Baylies, physical chemist, Chicago, stated that he could not become enthusiastic over applying carbon directly to the filters with the hope of appreciable savings. Experimental work at Chicago (not using the batch process, however) indicated that there was

little difference in applying carbon before, with, or after the coagulant.

Other papers in the purification division included a description of an iron removal plant at Jamaica, N. Y., by Peter Ley, plant superintendent, and a discussion on operating experiences at the Chickasaw, Ala., filter plant by J. E. Jagger, chief engineer, Alabama Water Service Co. and A. Clinton Decker, sanitary engineer of the Tennessee Coal, Iron & Railroad Co. Birmingham, A. E. Gorman, engineer of water purification, Chicago, and Abel Wolman, professor of sanitary engineering, Johns Hopkins University, presented statistical data on waterborne outbreaks in the United States and Canada.

The joint committee on boiler feedwater studies, C. H. Fellows, Detroit Edison Co., chairman, discussed intercrystalline cracking, silica removal with ferric sulphate and deaeration as a method for reducing corrosion.

Management and Accounting

A GENERAL PICTURE of sewer-rental procedure and its relation to water-rate charges was presented by Robert Allton, consulting sanitary engineer for the city of Columbus. It was pointed out that one of the principle differences between sewer rents and water rates is that the former are based on operation and maintenance costs only while water rates are designed to cover all costs of service. Another difference is that water service is billed only on the basis of quantity while sewer rents, if they are equitable, must take into account not only the quantity but the strength of the sewage as well. Unfortunately, he said, there are no means available for directly and continuously measuring the volume and strength of sewage discharges from premises.

The various methods used in making sewer-rental rates were stated to be: (1) a flat-rate charge which is based on the type of building served by the sewer connection; (2) a flat-rate schedule based on the number and type of fixtures; and (3) a charge based on the quantity of consumption registered on the water company meter. The latter scheme is the most common but, like the others is not entirely equitable.

In a discussion of sewer rentals W. W. Morehouse, superintendent of water, Dayton, Ohio, reported that charges in this city are based on metered water. He felt that this arrangement was not entirely equitable because on the one hand it penalized those who did not discharge all used water into the sewer, and on the other hand failed to tax those who had private wells but discharged into public sewers. Charges for sewer service in Minneapolis and St. Paul, according to C. C. Wilbur, engineer of the water department, were based on a percentage of the water metered in the period of Oct. 15 to April 15—this eliminates charges on water used for lawn sprinkling. Private well owners have been required to install meters. The revenue from the rentals is designed to pay only for operation and maintenance costs of the disposal system. Cedar Rapids, Iowa, has a sewer rental rate equal to 25 per cent of the water charge and this revenue covers the entire capitalized cost of the disposal plant as well as operation costs, according to N. E. Blomquist, superintendent of the waterworks.

Public relations counsel

Helpful suggestions in establishing sound public relations in municipal water supply service were outlined by Ralph Cooney, advertising manager of Bing & Bing, Inc. New York. Favorable community interest in what the water department does is one of its best assets, yet this creation of public interest was held to be one of the most grossly neglected elements of management. Among other things the waterworks should invite people, perhaps by a printed notice on bills, to visit the treatment works; courteous attention should be given to visitors and the grounds should be landscaped to encourage frequent return visits.

Waterworks officials were urged to make public appearances whenever the opportunity offered so that the citizens would become informed about, and develop appreciation of, the service that is rendered. Conducted tours through the plant for school children were also recommended. In making information available regarding plant capacity, the size of reservoirs, etc., avoid the use of statistics that look like "social security numbers," said Mr. Cooney, and use simple comparisons instead.

The special care observed by the City Water Co. in Chattanooga to avoid accidents and law-suits for negligence was pointed out by T. W. Coleman, assistant manager, who laid particular stress on the hazards of curb meters. This arrangement, consisting of a meter inside of a cast-iron box located near the curb line, is widely used in the Southeast. Should the box become moved up or down, or should the lid become broken, it offers a hazard to pedestrians; accident cases invariably result in a law-suit against the company. To minimize accidents, all meter readers are now required to turn in a daily report on the condition of hazardous boxes and repairs are made immediately. This procedure not only corrects accident-inviting conditions but, since meters are read once a month, the dated report also serves as evidence that the company has not been wilfully negligent.

How Dallas maintains high efficiency among its city employees, which includes the water department personnel, was outlined by John B. Winder, who described the merit system in operation at that place. Employees selected from civil service lists are first given a three-months trial during which they are carefully watched to determine their fitness. After permanent appointment is made all employees are "rated" every three months by the department head.

Each employee starts with a rating of 75 per cent; if his performance is only of average caliber this rating remains unchanged. However, whenever the employee shows himself to have increased in value credits are given varying from ¾ of one per cent to 7 per cent. Inefficiency and negligence are penalized with debits. Should an employee's rating drop below 70 per cent he is dropped from the service. Men with the highest ratings are rewarded with salary increases and promotions whenever opportunity affords.

Decrying the lack of interest shown by the waterworks profession in training and recruiting young men for service in sanitary engineering, H. E. Babbitt, professor of sanitary engineering, University of Illinois, indicted the association, industry and educators for failure to cooperate.

The attitude of the association toward promotion of this cooperation was described as "sympathetic, kindly and . . . futile"; this neglect of matters pertaining to the education and employment of trained personnel was held to be contrary to the objectives of the association.

The waterworks industry was urged to participate in aggressive recruiting of college graduates in the same manner that other progressive industries have sought to develop their staffs. Educators, he said, have failed to keep in step with new demands by not modifying their courses of instruction to best fit men for particular types of work.

Accounting manual submitted

Submitted in final form was the manual of waterworks accounting which was prepared by the Municipal Finance Officers Association in cooperation with the American Water Works Association. It has been designed as an administrative guide on uniform accounting and financial procedure including information on the use of control accounts, payroll procedure and assignment of office duties. It also contains information on the sale of bonds and the handling of sinking funds for debt retirement. Hal F. Smith, superintendent of accounts and collections, Detroit water department, is chairman of the manual committee and Carl H. Chatters, executive secretary of the Municipal Finance Officers Association, Chicago, represented his group in the work.

Practices in the water sales division of Los Angeles relating to service charges and water rates were described by Thad. M. Erwin, water sales agent. All property in the city is subject to a street main assessment charge of 80c. per front foot to cover water main installation cost; this charge must be paid before services are put in, the length of the service pipe being limited to 200 ft. Where the distance is greater than 200 ft. and the main itself must be extended, a deposit of $1.60 per lin. ft. must be made; this deposit minus 80c. per front foot is refunded when assessment charges are collected from other consumers attached to the extended main.

In new subdivisions the city will make estimates on the installation of a complete water system consisting of main, service connections, and fire hydrants to serve the entire tract. This estimate provides for piping at the rate of $1.60 per lin. ft. plus $100 for each fire hydrant installed.

The procedure used in maintaining a continuous property record was described by Carter H. Lamb, valuation engineer of the Jamaica, N. Y., water company, who stated that such records would aid in establishing uniform and definite information on costs and description of property. Retirement lists for water utilities, now in the course of preparation, said William Schwartz, controller of the Hackensack Water Co., should provide a means for establishing uniform procedure for valuation studies.

Discussions dealing with classification of accounts were presented by Louis D. Blum, certified public accountant of New York and E. W. Morehouse of the Wisconsin Public Service Commission.

Directors and awards

New directors elected for the term 1938-1941 were:

Roger W. Esty, superintendent, Danvers, Mass., Water Board; Clinton Inglee, president, National Water Main Cleaning Co., N. Y.; E. E. Jacobson, manager, Lexington, Ky., Water Co.; H. Lloyd Nelson, Eastern sales manager, U. S. Cast Iron Pipe & Foundry Co., Philadelphia; S. F. Newkirk, Jr., Engineer, Board of Water Commissioners, Elizabeth, N. J.; W. A. McCaffrey, superintendent, Oswego, N. Y., Water Department; E. L. Waterman, professor of sanitary engineering, University of Iowa.

Elected to honorary membership were Theodore A. Leisen, general manager, Metropolitan Utilities District Commission, Omaha, and Ralph W. Lawton, civil engineer, Los Angeles, Cal.

The John M. Goodell Prize, awarded by *Engineering News-Record*, was given to Vance C. Lischer, engineer of the St. Loyis County Water Co., for a paper on water hammer correction (*Jour.* A.W.W.A., Mar. 1937). The John M. Diven medal was presented to William C. Mabee, chief engineer, Indianapolis Water Co., in recognition of his outstanding service to the association.

The George W. Fuller Memorial Awards were presented to Albert E. Berry, Canadian section, Joseph I. Lyles, Florida section, L. S. Vance, Kentucky section, Charles H. Capen, New Jersey section, Edward A. Sterns, New York section, Guy H. White, Southeastern section, William C. Mabee, Indiana section, Charles M. Roos, Illinois section, Claude W. Eyer, Montana section.

The Water Works Manufacturers Association elected the following officers: H. W. Ford, Pittsburgh-Des Moines Steel Co., president; Edward Johnson, Pittsburgh Equitable Meter Co., vice-president; Edgar Buttenheim, *The American City* magazine, treasurer; and John Kienle, Mathieson Alkali Co., secretary.

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Short Fishplates Tried On British Railway Line

FISHPLATES only 9 in. long are being used experimentally on the London Midland & Scottish Ry. in place of the railroad's standard 18-in. plate, according to a report to the U. S. Bureau of Foreign and Domestic Commerce. The railroad is also experimenting with a new type of rail joint with which a similar short plate is used.

The L. M. & S. uses double-headed rail supported in rail chairs and the joints are of the simple bar type. The new 9-in. bar has but two bolt holes, 2 in. from the outer end of the bar. Its use permits the rail chairs to be brought up close to the end of the rail, the center being only 7 in. from the rail end, thus giving a very short section of rail on which dependence for stiffness is placed in the joint bar. These short fishplates are to be used on 238 miles of track.

The new rail joint, which is patented in England by Alfred Brogden, is similar to joints with which experiments have been made in this country in the past. Half the body of the rail is cut away along the vertical axis for a distance of 9 in. back from each end of the rail thus permitting the ends to overlap 9 in. when laid in the track. In this joint assembly a fishplate only 6¾ in. long is used and the rail chairs are brought to within 5¾ in. of the rail end. When so placed both expansion openings are in the rail chairs. A few of these special joints have been in freight track for over two years and in passenger track for six months.

Longest U. S. Girder at Topeka

JACK SINGLETON

District Engineer, American Institute of Steel Construction, Topeka, Kansas

Span of 217 ft. occurs in new five-span continuous plate girder bridge over Kansas River.

STUDIES of alternative types of bridges for the Kansas River crossing of U. S. Highway 75 at Topeka, Kansas, led to the selection of a 5-span continuous deck plate girder bridge of unusual proportions. The central span of 217 ft. is thought to be the longest plate girder bridge span in the United States. The types of bridges studied by the consulting engineers included open-spandrel concrete arches of five, six, and seven spans, continuous steel deck trusses having a center span of 350 ft. and continuous deck plate girders of five, six, and seven span combinations.

Railroad crossings and grade requirements fixed the overall length of the bridge and approaches at 4,396 ft.; the length of the river crossing is about 900 ft. The roadway is about 40 ft. above grade back of the dikes on either side of the river, and 70 ft. above normal low water. The streambed consists of sand, extending down to shale at a depth of about 65 ft. below normal low water. Since deep scour usually accompanies high water it seemed advisable to extend all foundations to shale with pneumatic caissons. All bridges studied and the final design selected carried a 44-ft. roadway and two 5½-ft. sidewalks.

The concrete arch designs were found to be prohibitive in cost because of the extremely great distance from bottom of footing to springline. The continuous steel deck truss was slightly cheaper than the steel girder designs, but from an esthetic standpoint did not harmonize with the plate girder approach spans. A plate girder bridge therefore was finally selected, and after due consideration of economy and esthetic values the 5-span layout having span ratios of 5-6-7-6-5 was determined upon. The center span is 217 ft., flanked by 186-ft. spans, while the end spans are 152 ft. The lower chords of all spans are continuous parabolic curves, which harmonize with the parabolic haunches of the approach girders.

All girders are 16 ft. 1 in. deep over the piers, and 8 ft. 1 in. at the center of the spans. The flanges are composed of 8x8x⅞-in. angles, with 20 in. cover plates of the thickness required at the various sections, the maximum being 2 in. Web plate thicknesses vary from ½ to ⅝ in.

The bridge was designed for an H-20 loading, and is composed of 4 lines of girders spaced 14 ft. 8 in. on centers. Cross-frames, spaced 15½ ft. on centers, carry the continuous 16-in. rolled-section stringers which, with the main longitudinal girders, support the reinforced concrete deck slab. Public utilities, such as water, gas, electric conduit and telephone cables are carried under the floor slab on the cross frames. Pylons at each end of the bridge were designed not only with a view toward an artistic treatment of the bridge as a whole, but also to enclose stairways leading to the surface levels below, adjacent to the river.

The preliminary design of the girders was made by the method of conjugate points, as presented by L. H. Nishkian and D. B. Steinman in *Transactions*, Am. Soc. C. E., Volume 90, 1927, and the final design by the method of elastic weights, assuming the reactions as redundant. Check computations were also made.

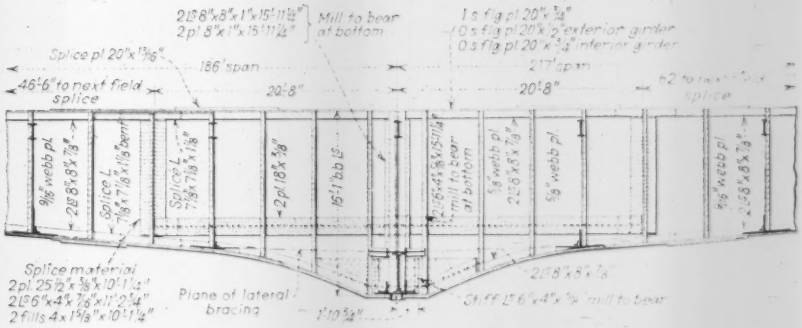

Fig. 1. Details of continuous girder at pier between 186 and 217-ft. spans

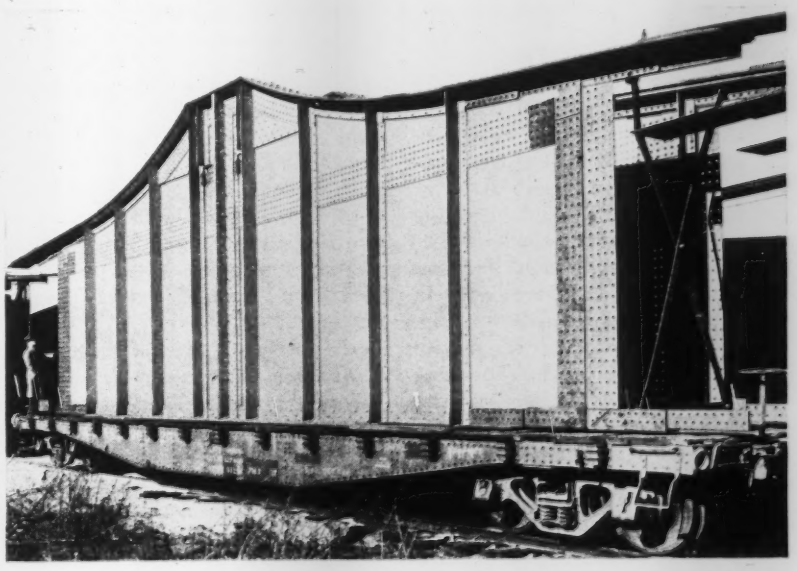

Fig. 2. Pier section of record span girder has a maximum depth of 16 ft.

Fig. 3. Erecting the new high-level girder bridge over the Kansas River at Topeka. The ornamental abutment contains a stairway from the deck to the levee level.

Treated as a 5-span continuous structure, the bridge was fixed at the second intermediate pier, with cast steel rockers at all other piers to allow for change in length. Heavy finger-type expansion joints are located at each end of the bridge.

As shown in Fig. 3, erection was by means of a stiff-leg derrick deck traveler. Another stiff-leg derrick behind the south abutment (and not visible in the photograph) picks up the steel from railroad cars and swings it to push cars on the deck which are then run out to the point of use. The same procedure is being used in placing the concrete deck and in erecting the handrail.

R. A. Finney and Stuart G. Hazard were associated in preparing the plans, being employed by the city of Topeka. The contract for the river span was let by the Kansas highway department early in 1937 to the Missouri Valley Bridge & Iron Co. and the Kansas City Bridge Co. who are associated on the work. The structural steel was fabrciated by the Kansas City Structural Steel Co. O. J. Eidmann was engineer of design of the state highway department at the time the contract was awarded. Charles Turnipseed and George Lamb were active in the preparation of the design for the consulting engineers. The firm of Robinson & Steinman, New York City, was retained as consultant by Finney & Hazard.

Cement-Lined Cast-Iron Pipes

CEMENT LINING spun into cast-iron pipes is standard practice for 12- and 16-in. transmission mains in San Francisco's water system. This city makes distinction between "transmission" and "distribution" pipes at the 8-in. diameter. The former classification includes all over 8 in.; pipes of the latter classification are those having diameters of 8 in. and less, usually 4, 6 and 8 in. The reason for making distinction at the 8-in. size is that the fire underwriters, with a view to adequate fire protection, insist on a minimum of 6- and 8-in. diameters where pipes as small as 3 or 4 in. would be adequate for all service other than fire protection. Thus there is ample capacity in the sizes required for fire emergencies to allow for considerable tuberculation without imposing any restriction on the maximum capacity required in ordinary service.

San Francisco does not stock nor use 10-in. pipe. The size in use next above 8-in. diameter is 12 in. In 12-in. sizes and larger, the city began about 10 years ago to use cement lined pipe with a view to maintaining maximum capacity for a period longer than would be possible (by reason of tuberculation) with unlined cast-iron pipe even with the best dip treatment which the city knew how to apply.

The cement lining is about $\frac{1}{8}$ in. thick, is applied at the factory by the centrifugal process and is now standard requirement for all cast-iron pipe of 12- and 16-in. diameter which is purchased by the city. Fabricated steel is used for pipes of larger size.

Where it is necessary to cut into one of the cement-lined pipes from the outside with a cold chisel it has been found that the cement lining breaks out evenly and chips off around the hole never more than about $\frac{1}{2}$ in. back from the periphery of the opening. Thus far there has been no difficulty with portions of the lining breaking loose and no trouble whatever has been reported chargeable to the cement lining.

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New York University Forms A New Department

A NEW DEPARTMENT, engineering mechanics, has been set up in the College of Engineering of New York University. The new department, which is intended to consolidate basic technical courses, will take over courses in statics, dynamics, strength and elasticity of materials, special topics in applied mechanics, fluid mechanics, and engineering drawing; these are required courses for all students.

Hitherto, according to Dean Saville, these basic courses were administered by several different departments which devoted their chief energy to the more specialized courses.

Assistant Dean William R. Bryans has been made chairman of the new department.

THE WEEK'S EVENTS

(Continued from page 702)

Commission Will Study Alaskan Highway

An Alaskan International Highway Commission to negotiate with a similar Canadian commission on the financing and construction of a highway connecting the northwestern United States with Alaska through British Columbia is created by a bill passed May 2 by the House of Representatives and sent to the Senate for further action. The commission would be made up of one member from Alaska, three from the United States, and a member of Congress. It would serve for three years, without pay.

Prime Minister Patullo of British Columbia and Anthony J. Dimond, territorial delegate to Congress from Alaska, have been pushing negotiations for the highway for some time. The Prime Minister has made two visits to Washington and has also conferred with Canadian authorities at Ottawa in an attempt to reach an agreement. (*ENR*, April 28, 1938, p. 607).

It is understood that the principal difficulty lies in financing the road, estimated to cost $17,000,000, and it has been proposed that the United States advance a substantial part of this amount to British Columbia as an interest-free loan.

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Montana Road Conference Held in Mississippi

Black-top roads will be discussed Oct. 17–20 when the Montana National Bituminous Conference convenes at Edgewater Gulf Hotel, near Biloxi, Miss. The conference is sponsored jointly by the Montana highway department and the Western Petroleum Refiners Association.

As in previous years, the conference will be divided into sections, and committees of twelve will prepare material and data to be presented to each section.

N. W. McLeod, research engineer of the department of highways and transportation of Saskatchewan, will be chairman of the section on progress in research on construction and maintenance of bituminous surfaces. A section on fundamentals of bituminous construction will be headed by T. E. Stanton, materials engineer of the California highway department. V B Steinbaugh, chief engineer of the Michigan state highway department, will be chairman of a section on construction of bituminous surfaces; and A. B. Nuss, chief highway engineer of Kansas, will be chairman of the section on maintenance of bituminous surfaces.

D. A. McKinnon, state highway engineer of Montana, is chairman of the executive committee. C. M. Boggs, president of the Western Petroleum Refiners Association, and D. L. Cheney, bituminous engineer of the Montana highway department, are vice chairmen.

PERSONAL

COL. CHARLES R. PETTIS, who has been in charge of the U. S. Lake Survey Service at Detroit for the past two years, has been put in charge of the U. S. District Engineer's office there to replace Colonel Peterson, who has been transferred to Chicago. Colonel Pettis will direct both the lake survey and the engineer's office.

JOSEPH F. KUNESH has been made director of the newly-created territorial planning board of the Territory of Hawaii. After his graduation from the University of Wisconsin in 1914, Kunesh worked for the Wisconsin highway commission. He later had experience on New York subway work and a number of railways in the East and on irrigation and water supply projects in the western states and in Texas. He was for several years chief hydraulic engineer for the Republic of Haiti and for the past ten years he has been connected with the engineering department of the territorial government of Hawaii and of the city of Honolulu.

W. N. REES, construction engineer for the Tennessee highway department in the divisional office in Jackson, has been promoted to the rank of planning engineer with headquarters in Nashville.

ROY E. BROWNMILLER, deputy secretary of highways in Pennsylvania, has been appointed secretary to succeed the late Warren VanDyke. He has been in business and in Pennsylvania politics for a number of years.

SAMUEL M. ELLSWORTH has been appointed lecturer on sanitary engineering design at Harvard University Graduate School of Engineering under the Gordon McKay endowment.

FRED E. SWINEFORD has been appointed chief engineer of the bureau of tests of the Ohio state highway department. He succeeds Robert R. Litchiser, who has resigned.

J. LESTER BOOKER, engineer for the Arkansas state highway department and employed by the department for the past 15 years, has resigned to become a candidate for the office of state land commissioner.

HOWARD A. ANTRIM has been appointed engineer of the Kaw Valley Drainage Board at Kansas City to succeed the late P. A. Williamson. A graduate of the University of Kansas, Antrim has recently been employed by the N. P. Severin Co. of Chicago on the construction of a high school in Kansas City, has been an engineer for the U. S. Public Health Service, the federal Soil Conservation Service, and the Kansas City Board of Education.

GEORGE MCLEOD has been made district engineer for the British Columbia department of public works.

HARRY A. CIUFI, resident engineer inspector for the PWA on construction of buildings for the Golden Gate International Exposition at San Francisco, has been transferred to Hilo, Hawaii, on construction of a concrete arch bridge over the Wailuku River.

E. E. NELSON has been made county engineer of Plymouth county, Iowa. For the past 20 years, Nelson has been an employee of the Iowa highway commission. He is a graduate of Iowa State College.

GUY JOHNSON, division engineer for the Montana state highway department, has been appointed head of the highway testing laboratory.

JAMES L. STOVER has been appointed county engineer of Butler county, Iowa.

R. S. BRABROOK, formerly with the Bethlehem Steel Co. on construction of the navigation locks at Bonneville Dam, is now design engineer with Consolidated Builders, Inc., Mason City, Wash.

COL. DANIEL I. SULTAN, who has been engineer-commissioner for the District of Columbia for the past four years, is to be transferred to Fort Logan, Colo., in the late summer.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 27-July 1.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, annual meeting, Texas A. & M. College, College Station, Texas, June 27-30.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, summer convention, Washington, D. C., June 20-24.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, Hotel Utah, Salt Lake City, July 20-22.

REGIONAL AND LOCAL

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION, annual conference, Emerson Hotel, Baltimore, May 19-20.

SECTION MEETINGS, American Water Works Association:
Pacific Northwest, Spokane, May 19-21.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, Hotel Commodore, New York City, May 20-21.

PENNSYLVANIA SEWAGE WORKS ASSOCIATION, annual conference, State College, Pa., June 8-10.

ELECTIONS AND ACTIVITIES

OFFICERS elected at the thirteenth annual conference of the Michigan Sewage Works Association early last month were as follows: president, H. P. Dodge; vice-president, Allan Kronbach; director, L. F. Oeming, secretary-treasurer, W. F. Shephard.

THE FIRST ANNUAL CONFERENCE on roads and streets in Arizona was held at the University of Arizona in March, sponsored by the University, the state highway department, and the Arizona section of Am.Soc.C.E. More than 200 attended. Agreement was reached on standardization of road signs and the necessity of proper super-elevation in light asphaltic pavement.

WILLIAM P. HUGHES, city engineer of Lewiston, has been elected president of the Idaho Society of Engineers. W. P. Havenor, Raymond J. Briggs, and Frank H. Hummel have been re-elected vice-president, secretary and treasurer, respectively.

THE NORTH CAROLINA SECTION of the American Society of Civil Engineers elected the following officers at its annual meeting late last month: W. E. Vest, president; O. B. Bestor and A. C. Lee, vice-presidents; H. C. Bird, secretary.

THE MID-SOUTH section of the American Society of Civil Engineers at its annual meeting early this month elected the following new officers; W. E. Elam, president; Paul C. Gauger, vice-president; R. C. Gibson, secretary-treasurer.

THE GOLDEN ANNIVERSARY of the Engineers Club of Columbus was celebrated by a dinner dance May 5. Dean emeritus E. A. Hitchcock of the College of Engineering of Ohio State University spoke on his experience in compiling a history of the club, and Willard Chevalier, publisher of *Engineering News-Record*, gave an address, "Yesterday and Tomorrow." Honor guests were C. E. Sherman, F. W. Jennings, and C. H. Mollay, all of whom participated in the organization meeting of the club in 1888.

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Short Course

A TRAINING SCHOOL for highway superintendents will be held at Cornell University, Ithaca, N. Y., June 22-25. It is sponsored jointly by the Town and County Officers Training School of New York State, the State Association of Superintendents of Town Highways, the State College of Agriculture, and the College of Engineering.

OBITUARY

EMORY SUDLER, a civil engineer for the Baltimore water department for many years in the early part of the century, died in Washington, D. C., April 21 at the age of 68. Sudler had also done work in railway and rapid transit fields.

ERNEST M. SPRAGUE, construction manager for the Bethlehem Steel Co. for 18 years, died in Cleveland May 8 at the age of 73. Sprague had been connected with bridge construction work since 1891 when, three years after his graduation from the University of Michigan, he became assistant bridge engineer for the Chicago & Northwestern Ry. He served briefly with various railroads and bridge companies until in 1900 he joined the American Bridge Co. as construction manager. He later joined McClintock-Marshall, and joined Bethlehem in 1920.

CHARLES C. HOPKINS, consulting engineer of Rochester, N. Y., died there April 30. A graduate of Lehigh University, Hopkins had practiced in Rochester since 1910, for some time in partnership with A. M. Field, specializing in hydraulic and sanitary engineering.

GUY W. CARLTON, 63, vice-president and treasurer of the Harding-Carlton Corp., Buffalo general contractors, died in Baltimore May 1. Carlton graduated from the Sheffield Scientific School of Yale University in 1900. He was formerly vice-president of the John W. Cowper Co., served as an officer during the war in charge of cantonment construction, and had been in business in Buffalo since that time.

WILLIAM D. ROBERTSON, consulting engineer and purchasing agent for the Nova Scotia highway department, died in Halifax recently at the age of 68. Robertson practiced with his father in his youth and in 1904 joined the engineering staff of the Transcontinental Ry. as location engineer and later relocation engineer. After fourteen years with the Transcontinental he became district highway engineer for the Nova Scotia highway department, holding that position until 1925. He then practiced for some years in the United States and returned to the highway department in 1933.

J. W. T. STEPHENS, resident engineer for the Louisiana highway commission at Grande Isle, died in New Orleans May 3, aged 79. Stephens, a native of England, first began engineering practice in New Orleans as a member of the staff of the contractor on the city's first sewerage and drainage system in 1893.

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Nebraska Builders Endorse Wisconsin WPA Resolutions

Resolutions recommending changes in the WPA system of work relief passed last month by the Wisconsin construction industry conference were endorsed May 5 by representatives of the Nebraska chapter of the Associated General Contractors and the Nebraska Federation of Labor meeting as the Nebraska Construction Industry Conference. The conference voted to transmit the Wisconsin resolutions to Roosevelt, Ickes, Hopkins and to Nebraska senators and congressmen.

The Wisconsin conference (*ENR*, May 5, 1938, p. 637) recommended that relief workers be put on projects in their normal field of employment rather than in construction work and that unemployed construction workers be aided by an extension of the PWA program rather than by WPA. They also recommended that states be required to match federal relief funds.